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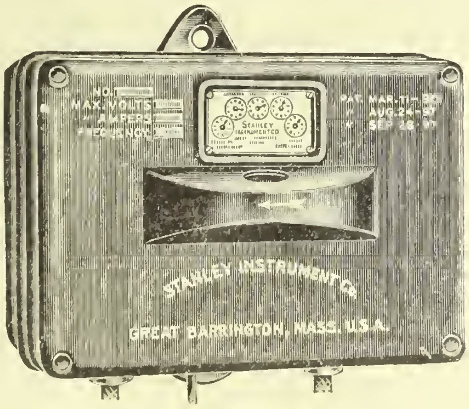

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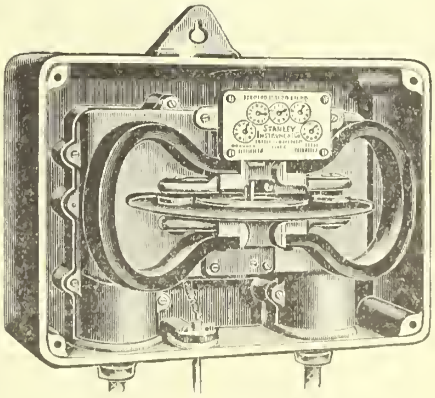

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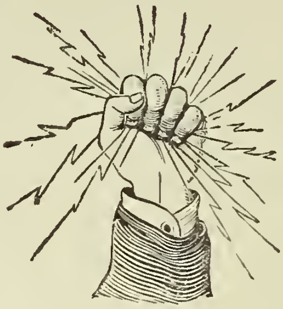

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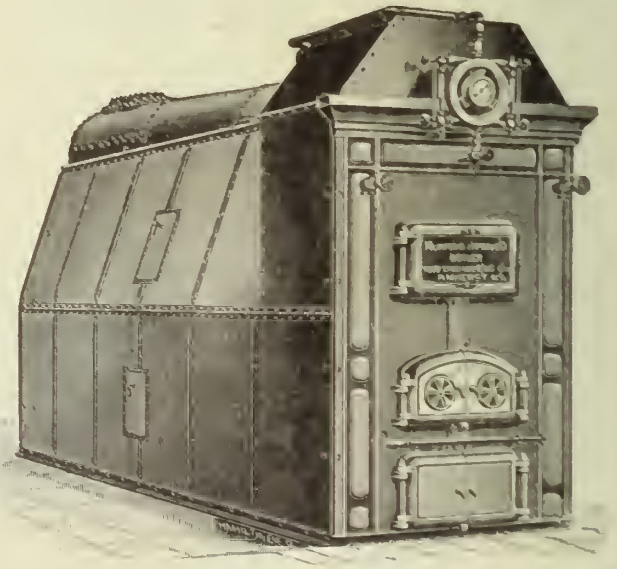

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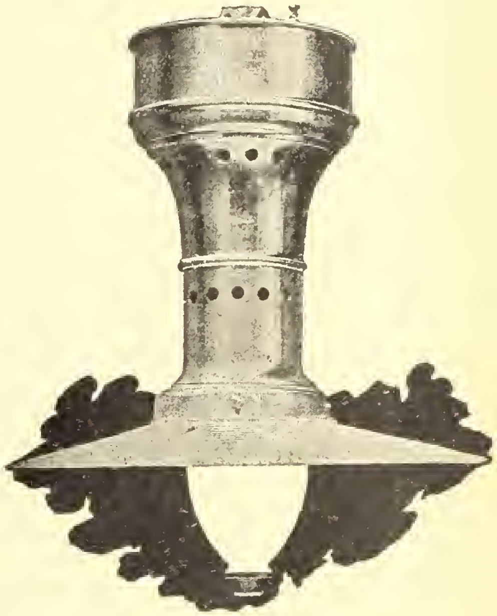

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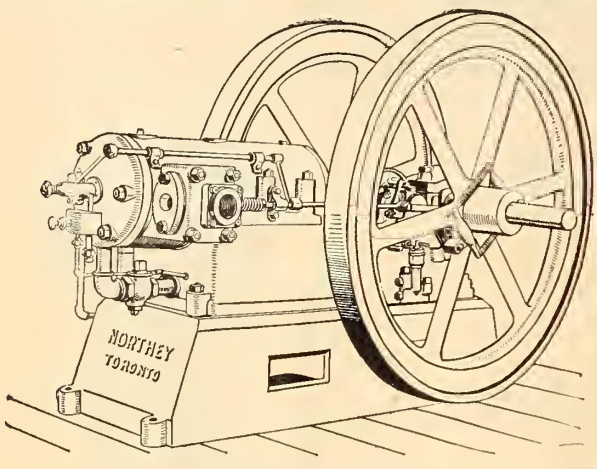

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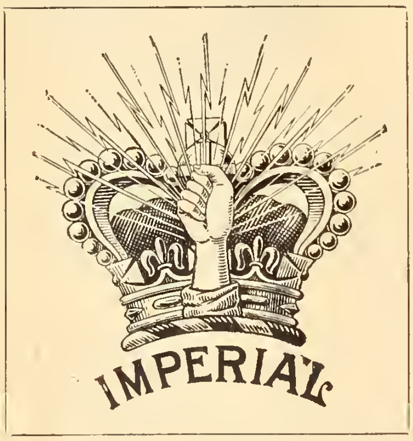

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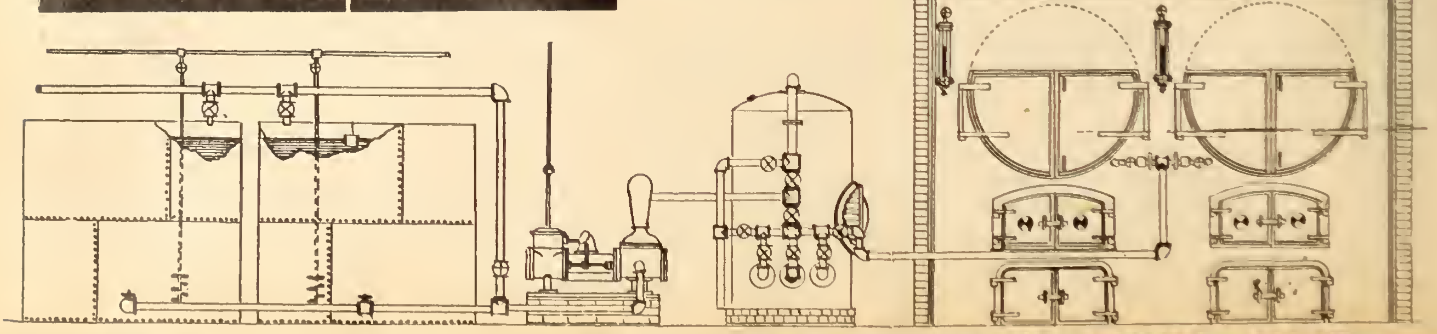

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THE CHAMBLY TRANSMISSION PLANT.

By E. M. Archibald.

The long expected day of transmission of electrical power from Chambly to Montreal arrived on Saturday, June 24, 1899, when the lines were finally tested, a lamp being lighted at the Chambly power house from the Montreal station. On Sunday, the following day, on of the huge generators was slowly and noiselessly started, the field excited, switches closed, and power was successfully transmitted into Montreal. The first use of the power was to test the transformers in the sub-station, but at 4 p.m. steam was shut off from the engines in the city plant, and until 5.30 p.m. those using the Royal Electric Company's power were, unknown to them, cut off from the city plant and supplied from Chambly, some 16½ miles distant.

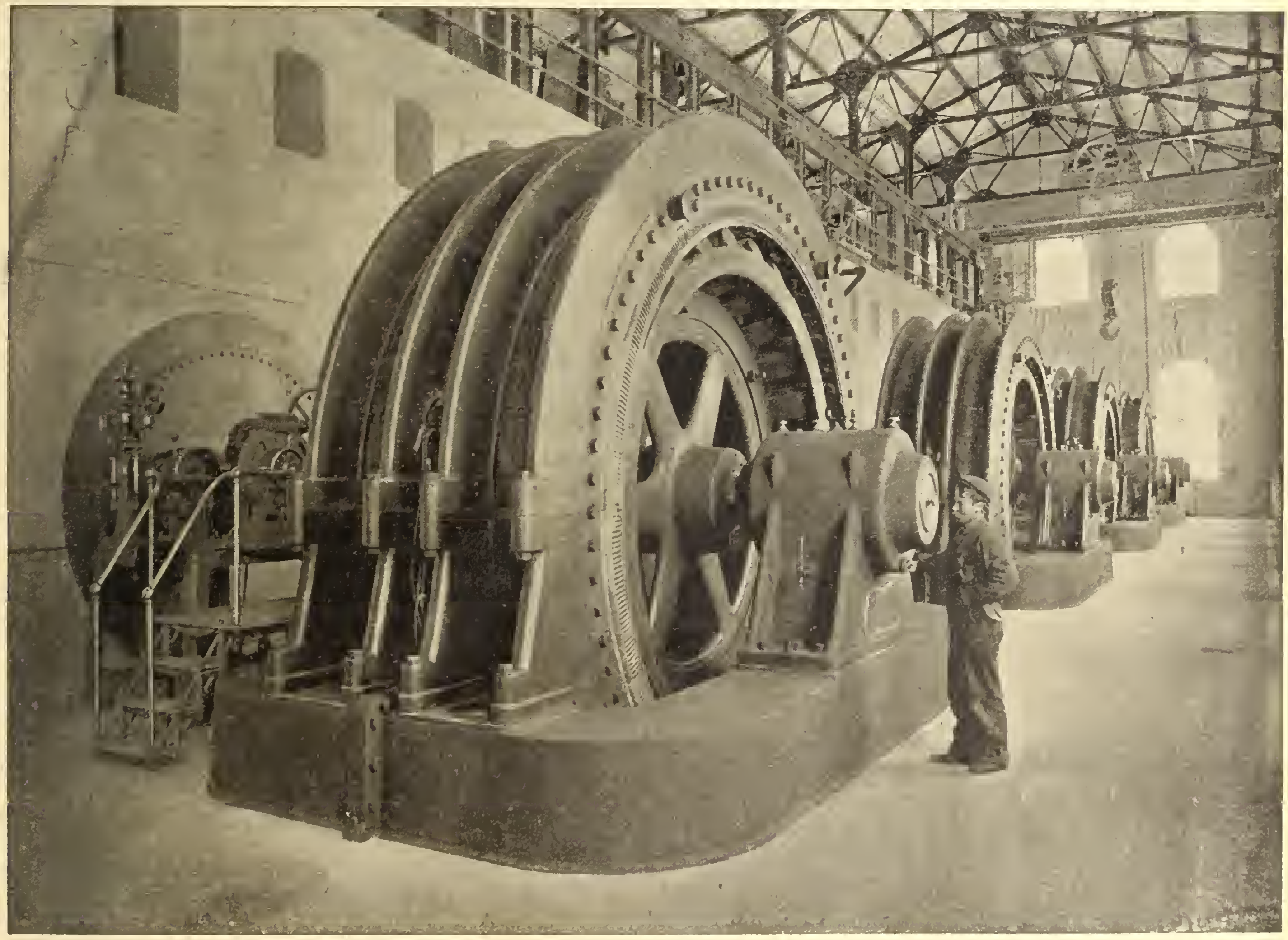

Fig. 1. Generating Plant at Chambly.

The Royal Electric Company has for many years been supplying the great bulk of the electric light and power service in the city of Montreal, Canada, and this has until the present been utilizing steam power for generating purposes. As early as 1893, however, they secured control of an immense water-power situated at Chambly, on the Richelieu river, about 15 miles from Montreal. It was found after careful calculation that the cost of water and steam power for the size of the plant necessary—8000 h.p.—was almost equal, but that for any increase in size, the water power decreased at a much more rapid rate than did steam. Consequently, the Chambly Manufacturing Company, the principal directors of which are interested in the Royal Electric Company, having been formed, this water power was sold to it, and a contract was drawn up whereby the new company was to supply the Royal Electric Company with a specified amount of power in Montreal, with provision for increase. One of the conditions of the contract is that the steam plant shall remain as at present for two years to provide for possible contingencies.

The hydraulic equipment of this plant has already

General View of the Chambly Power Plant.

been very fully described in these columns (issue of June last), and this article will therefore deal solely with the electrical equipment. This is of special interest in being very complete in all details, and in representing the latest design in high tension apparatus, as all the electrical apparatus, consisting of the large inductor alternators, the exciters, the high tension switches, and even the instruments, were specially designed for this plant.

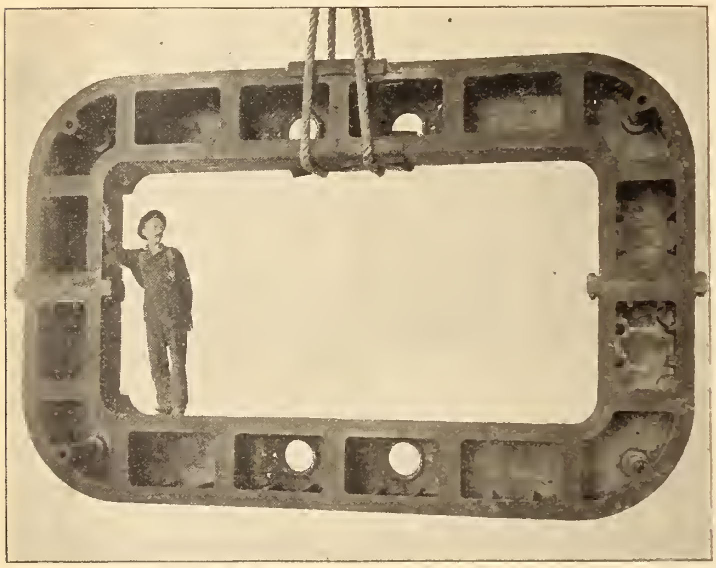

Fig. 2.—Base of Generator.

GENERATORS.

The principal machines are, of course, the alternators, of which there are eight, four installed at present, each a 2000 k.w. two-phase inductor machine running at 153 r.p.m., and generating current at 12,000 volts directly at the machine at 8000 alterations per minute, or 66 cycles per second. Generating directly at the line voltage, 12,000, disposes of step-up transformers with the necessary switchboards and transformer house. This is perfectly practicable with the induction type of machine, as there are no moving wires, both armature and field coil remaining stationary, while the huge inductor, consisting wholly of iron, is the only revolving element. Hence, it only becomes necessary to secure sufficient insulation in order to obtain any desired voltage.

All joints in the armature coils are made with the greatest care in order to withstand such a high pressure. The joint, after having been carefully soldered, is covered with several layers of pure rubber tape, over which a composition of rubber and sulphur is placed, and covered all over with several layers of insulating tape. The joint is then soaked in boiling paraffin wax, which vulcanizes the rubber, thus producing a joint such that there is no break in the complete insulation of the wire. Such joints as these are made in connecting the armature coils together, and for all switchboard work.

The base of one of these machines is a hollow rectangular piece of iron, whose outside dimensions are 17′ 2″ long, by 10′ 11″ wide, and 25″ thick, weighing no less than 100 tons. It is set on a concrete bed. Resting on this base is the armature, built up in two parts, an upper and lower, bolted together in the middle. The lower half penetrates the base and dips into an excavation in the concrete, thus making the height of the machine appear less than it really is. This armature, which is of the well known ribbed frame of the S.K.C. type, is 15′ in diameter, 6′ 6″ wide. The coils are all machine wound, very carefully insulated and intersect each other, the inner curving around the outer so as to be in quadrature or at a phase angle of 90 degrees.

The single field coil, resting on the armature in a slot specially prepared for it, has a slightly smaller diameter than the armature and is wound, not of wire, but of bare copper strip insulated with japan and insulating linen. The joints in this strip are butted together and soldered with a special solder, thus producing a joint no thicker than a copper strip, which possesses a greater tensile strength besides an equal conductivity.

The inductor, built of laminated iron and weighing 30 tons, is the only revolving element in the whole construction, and is built up very solidly, the poles each being securely bolted to the spider.

The air gap between the inductor and armature is ½ inch. The field excitation, as is the case in all S.K.C. machines, is very small, being only ¾ of 1 per cent. of the total output of the machine. The shaft to which the spider containing the inductor is attached is 12 inches in diameter and is coupled directly to the turbines. The pillow blocks are bolted securely to the base

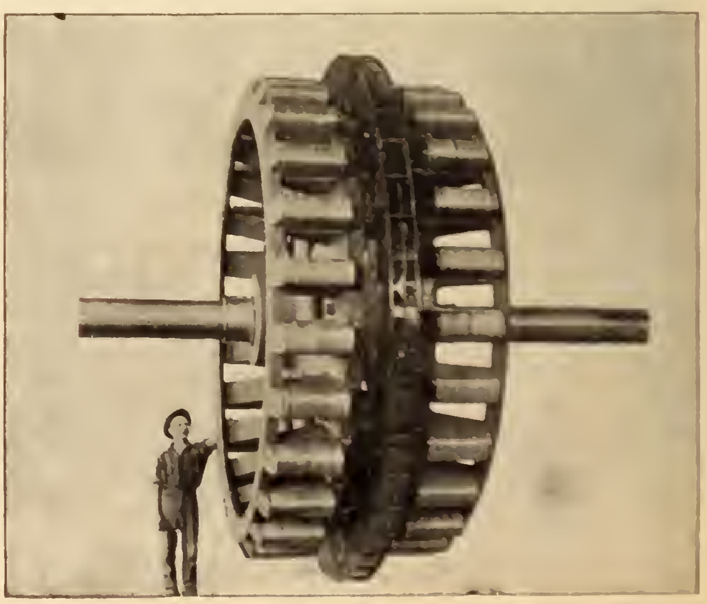

Fig. 3.—Inductor and Field Coil.

and the bearings are of the self-oiling and spherical-seated type.

The governor regulating the gates of each wheel is the Geisler electro-mechanical governor, manufactured and installed by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, and is geared directly to the governor shaft.

The two exciters, each of which is capable of fully exciting the complete installation besides running the crane motor, have each six poles, a capacity of 140 k.w. running at 266 r.p.m., and generating current at 75 volts pressure. They are of the large drum armature type, with large commutator, and are well ventilated. A feature is that they are shunt-wound machines. Regulation is afforded by Snow mechanical governors, belted to the exciter shafts. An electric crane having a capacity of 40 tons, from the works of the Shaw Electric Crane Company, Muskegon, Mich., runs the entire length of the dynamo floor.

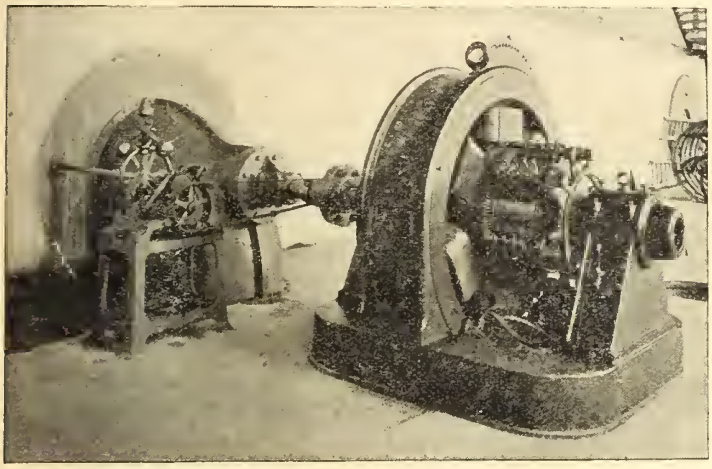

Fig. 4.—One of the Exciter Units.

From the alternators and exciters the cables pass through ducts in the concrete floor to the cable tunnel situated under the switchboard gallery. This cable tunnel has a vaulted roof, and is of sufficient height and width to allow free passage to several persons walking abreast. It is lighted and ventilated by casements in the concrete wall. These casements may be seen in the view of the dynamo room, directly below the switchboard gallery. The cables, which are all lead-armored from the works of the Washburn & Moen Co., Worcester, Mass., are placed on racks in the cable tunnel and are passed through ducts in the solid concrete to reach their respective places on the switchboard. The exciter cables are connected four in multiple, each of 400,000 circular mils, the four having a capacity of 2,000 amperes. The rubber insulation on all the cables is 5-32″ thick, and they are tested to 400,000 volts.

SWITCHBOARD GALLERY.

The switchboard gallery, situated as it is over the wheel pits, commands a view of the entire power house overlooking the dynamo floor. The switchboard, only half of which is at present constructed, is built of white Vermont marble panels, tested to 20,000 volts, on a frame of hardwood. The frame is seasoned cherry, and for further insulation and protection from fire is well soaked in asbestos paint. This makes it practically fireproof, and, besides, offers the additional advantage of being absolutely free of danger from accidental contact at all times, unlike a steel frame.

There are two sets of bus bars. These bus bars have a 5-32″ rubber insulation, with a thick jute outer covering. This was used instead of a lead armored bus on account of their being no possibility of a static charge collecting, as would be liable in the latter case. As it stands at present, the main switchboard contains nine panels, the first for the exciters, four for the generators, and the remainder the line panels.

The exciter panel contains the two double-pole single throw exciter switches and one double-pole double throw switch for connecting the electric crane motor to either exciter ; three ammeters, one for each exciter, and the other crane motor, the two exciters, voltmeters and rheostats. The machine panels are exactly similar to each other, so that a description of one applies to all. At the top of the board there are four instruments, two ammeters and voltmeters, the ammeters being placed outside, one set for each phase of the generator; below these are the voltmeters and ammeters for measuring the generator field excitation, while between them is the synchronizing apparatus, consisting of five lamps and a three pole switch, for each phase. The lamps are arranged three in the upper row, connected respectively to the upper bus bars, the three-pole switch being similarly connected, and two synchronizing lamps in the lower row. Then comes the generator field switch, the two main 12,000 volt switches, and lastly the field rheostat. The apparatus on each line panel consists of two ammeters, one for each phase, a static ground detector connected in any circuit as desired, and the two pole-line switches.

The main switches used on the generator and line panels are a new departure and need an explanation. They are special high tension switches for breaking a circuit of 12,000 volts and over, but are only necessary when such a high pressure is generated directly from the machines. As they appear on a switchboard there is only a small iron frame in which a long wooden lever may be turned through a 120 degree arc, and a small iron handle placed above. This latter is connected by means of a lever on the back of the switchboard, to two valves, each placed in an air duct into which air is pumped from a fan blower. These air ducts are two wooden boxes running the entire length of the switchboard, and are situated so that when the valve is open a jet of air impinges on the contacts of the high tension switch, thus destroying the arc. The iron handle

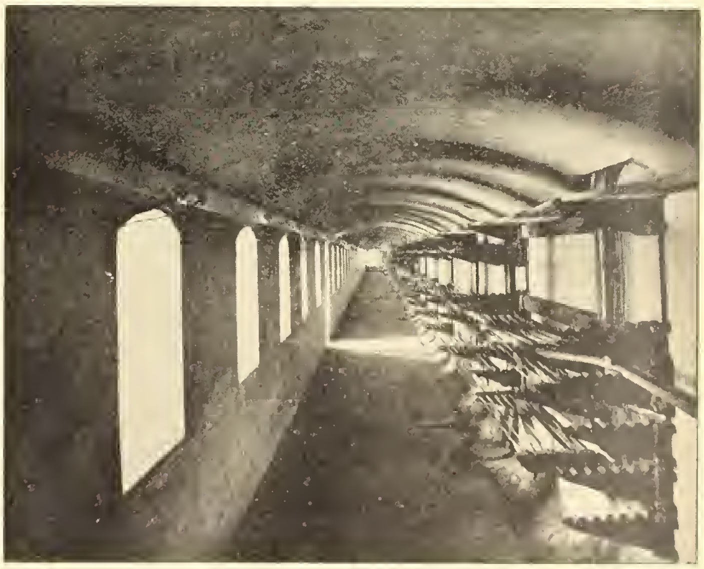

Fig. 5.—The Cable Tunnel.

directly above the high tension switch cannot be opened until the valve in the air duct is also opened, thus always insuring an air blast on the breaking contacts.

For the switch itself the moving lever on the face of the board is directly connected to a rocking lever which moves too and fro a trolley containing the dead side of the switch. This trolley moves forward and engages with one set of contacts connected to the upper bus bars, or backwards to the lower bus bars, according as the lever is moved to the right or the left of the centre. The contacts of the two sets of bus bars are 9 feet apart, and though the "off" position of the trolley is midway between the two, a break of 6 feet may be produced by moving the lever slightly past the center. There are two of these switches for each generator and line panel. To prevent arcs from jumping from one switch to another, they are separated by marble barriers two feet high.

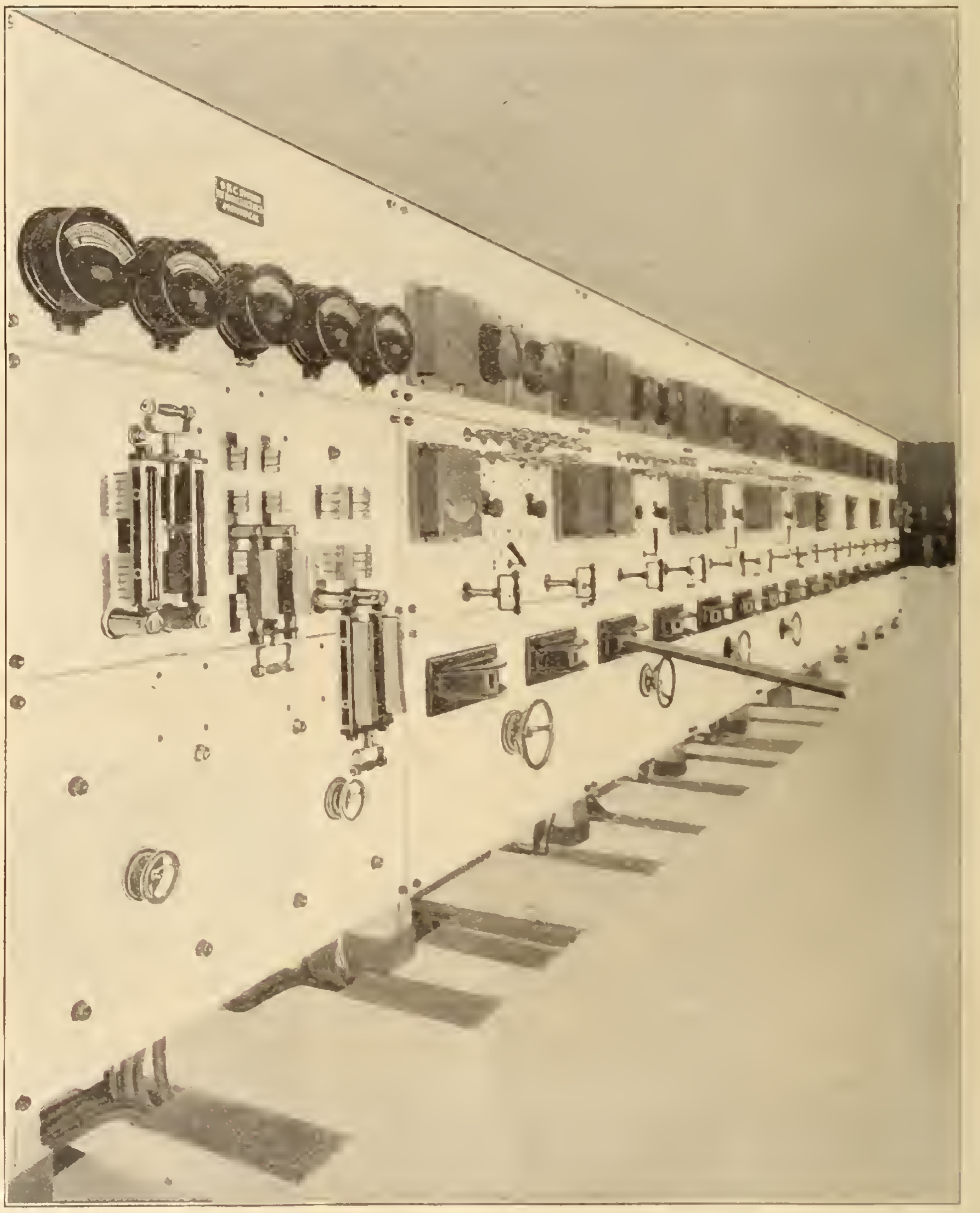

Fig. 6.—Special Switchboard for Handling 10,000 H. P. at 12,500 Volts.

All the ammeters and voltmeters in use on alternating current are enveloped in a handsome ground glass case to protect the switch-board attendant, should he persist in his habit of tapping the instruments, from receiving the shock he would get from an iron cased instrument should there chance to be a leak.

For supplying the air ducts with air two 45-inch Sturtevant fans are used, each direct-connected to a two-phase 500-volt S.K.C. induction motor, either being capable of keeping up the supply required.

To reduce the line voltage to 500—that required by the induction motors for the fans—four single-phase Stanley air-cooled transformers are used, a special switchboard for these, consisting of four white marble panels mounted on a hardwood frame, being installed at one end of the switchboard gallery.

The high-tension switches are of the bayonet stick type, each separated by heavy marble barriers. The low tension switches are the ordinary S.K.C. slide type. D. & W. non-arcing enclosed fuses protect the transformers on both the primary and secondary sides.

For a local circuit, the two 60 k.w. single-phase Stanley air-cooled transformers are also installed. The switchboard for these is similar to the one just described, except that it consists of only two panels.

POLE LINE.

From the front of the power house the line wires, still lead-armored, pass through quarter-turn porcelain tubes to prevent rain from leaking into the power house, through wooden ducts to the terminal house and thence to the pole line. There will be four 4-wire two-phase transmission lines on two separate pole lines, each 16.6 miles in length, although only two lines are as yet completed. No fuses or circuit breakers are used in the line, as the generators, on account of the great inductance of their armatures, will carry a short circuit for a short time without injury.

The pole lines are built very substantially, the poles being of white cedar, 45 feet long, 8 inches in diameter at the top, set 6 feet in the ground and spaced 90 feet apart. In places where it is necessary they are imbedded in concrete.

The transmission wires, four on each cross-arm, are No. 00 medium drawn bare copper, 18 inches apart, securely fastened to triple petticoat porcelain No. 1 Imperial insulators, tested to 40,000 volts. These are screwed to oak pins, which are in turn fastened to the cross-arm by a saddle bolt from below. For protection against lightning, there are three barbed wires grounded at every pole the entire length, one on top of the pole, the other two at the outer ends of the upper cross-arm; all are mounted on glass insulators, these being used on account of the lesser liability of fracturing the barbed wire and thus producing a short circuit than when secured by ordinary staples. Besides these are two banks of S.K.C. lightning arresters and choke coils at four places on the line where it passes underground, as well as at the power house. At such points there are eight gaps between each line and the ground, each gap being for 2,000 volts.

From the power house the pole line crosses the Richelieu river below the dam, the poles being imbedded in immense concrete piers, along the line of railway to the new Victoria Jubilee bridge, over a mile long, spanning the St. Lawrence. Here it passes into two wooden boxes, each containing one line, situated outside the guard rail. Thence it again takes to the poles on the company's right-of-way to the Lachine Canal, which it crosses in 3¼″ steel tubes, two wires each, placed 6 feet below the bottom of the canal, and thence to the sub-station. The line loss is about 10 per cent. at full load.

The line tests on June 24th proved perfectly satisfactory, not the slightest indication of a ground showing on the line, the pressure on which, as stated before, is 12,000 volts direct from the machines, without any interposition of transformers.

SUB-STATION.

The sub-station, situated on Prince street in the premises occupied by the Royal Electric Company, is a brick structure, the floor of which is several feet below the surface, for reasons to be developed later. This building has thoroughly water-proof foundations, even several feet above ground, on account of the tendency of the St. Lawrence to overflow its banks in the spring and produce a flood in the lower parts, though protected by dykes as they are.

The lead-armored cables enter from below, pass to a high tension switchboard, the switches, air ducts with their fan blowers and bus bars similar to those used in the power house previously described; thence to the transformers, the voltage being there reduced to 2300, the city pressure; thence back to the switchboard to what is called a transfer board, where the transformers may be coupled in any combination desired without any possible danger of short circuiting the line. The method of doing this is to have the plugs of one polarity slotted and keyed so as to connect with jacks of the same polarity. The needed instruments, ammeters, voltmeters, and ground detectors, all glass encased, are also situated on this switchboard.

There are twenty-four 200 k.w. single phase Stanley transformers immersed in mineral oil and water cooled, in three rows of eight each. Each transformer is enclosed in a rectangular cast iron tank, in which a free circulation is obtained through coils of pipe, the supply being obtained from the Lachine canal not far distant. The Royal Electric Company has a perpetual grant of water from this canal, obtained from the government, and for this reason the sub-station was excavated deep, so that the water would flow from the sub-station to the transformers by gravity. This sub-station is only one-third of the total output of the water plant, but permits of enlargement by removing some of the boilers used at present.

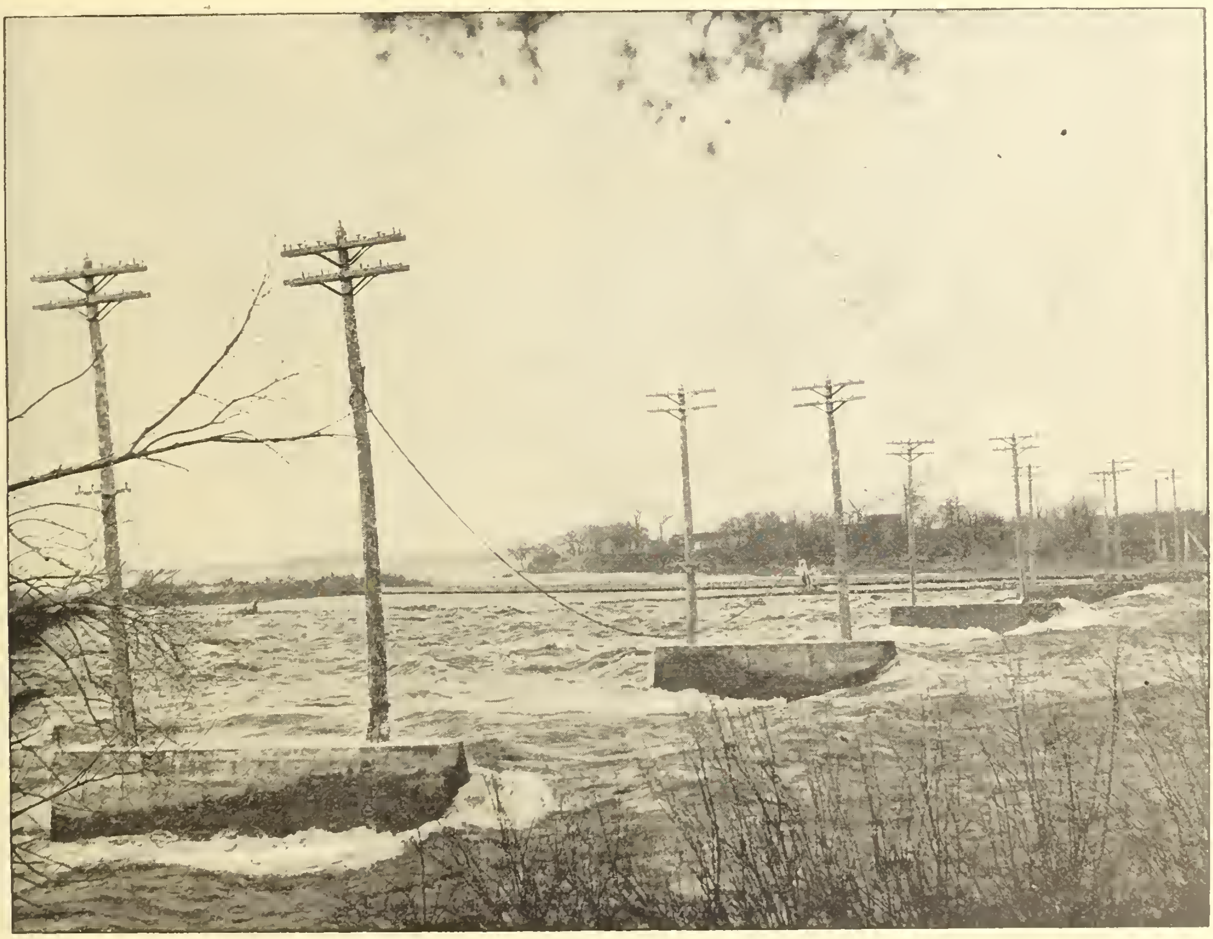

FIG. 7.—POLE LINE OVER RICHELIEU RIVER.

Each transformer is given a clear space free from obstruction, while situated directly in front is its switchboard, consisting of high and low tension sides, the switches on the former being of the bayonet-stick type mounted on a white marble panel, and each separated by a heavy marble barrier to prevent arcs from jumping across; the switches on the low tension side are of the S.K.C. slide type. Connected in the secondary of each transformer is a glass case ammeter indicating the load that each is carrying. The frame work of these switchboards is of white oak well soaked in asbestos paint and then erected and allowed to dry for upwards of a year. It was then given two coats of asbestos paint, after which it is practically fireproof. Each transformer is protected by D. & W. non-arcing enclosed fuses on both primary and secondary sides.

Power and light are supplied from the same circuits, the slight regulation being performed by hand at the distributing board, the machines themselves having an inherent regulation of 10 per cent. between no load and full load. As each phase is the independent in two-phase system, no method is needed to balance the loads on each phase, except that in order to obtain the full capacity of the machine each phase must be fully loaded.

The entire electrical equipment and machinery of the above plant was furnished and installed by the Royal Electric Co., of Montreal. The heavy machine work was done in their shops in that city, and the lighter work and assembling at the power house at Richelieu. The work is creditable to the Royal Electric Company.

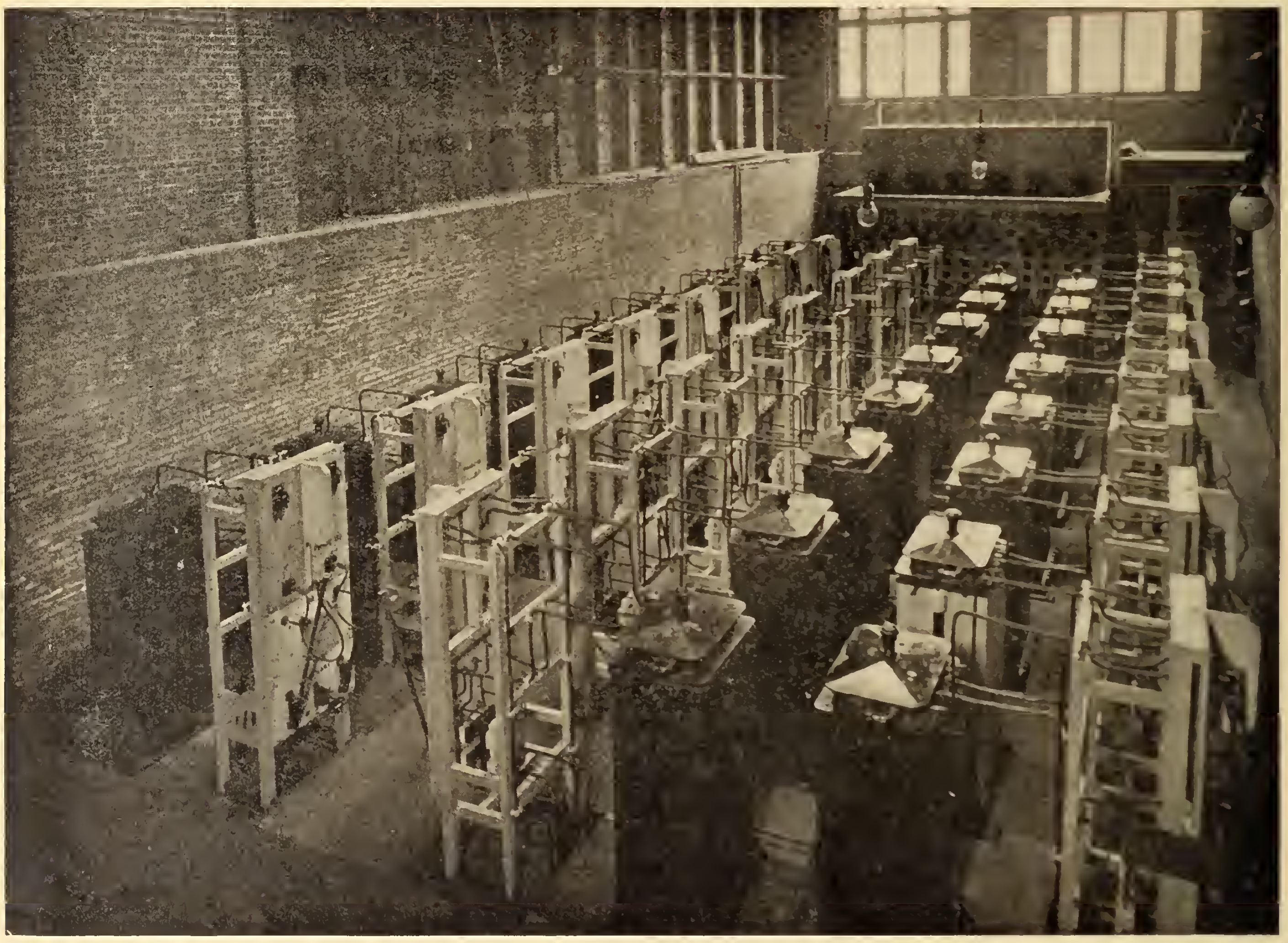

Fig. 8—Interior of Sub-Station in Montreal.

PERSONAL.

Mr. B. R. Laird, of Amherst N. S., has gone to Cuba, to set up the engines shipped there by the Robb Engineering Company.

Mr. Robert O. Boyd recently spent a short vacation in Toronto, previous to going to Denver, Col., where he has secured a position as manager of a large electrical company.

On December 20th last Mr. Chas. A. Barton, manager at Peterboro' of the Canadian General Electric Co., was married in Toronto to Miss MacDonald, daughter of Mr. Randolph MacDonald.

Mr. E. M. Davies, electrician, recently installed an electric light plant at Montague Bridge, P.E.I., for the Montague Electric Light Co. Before taking his departure he was tendered a complimentary dinner, at which Mr. Geo. Wightman, president of the company, acted as chairman. In replying to the toast, Mr. Davies expressed his regret at the severance of his relationship, and referred to the kindness received at the hands of manager of the company.

Capt. Thos. A. Brown, late of Montreal, but now engineer of the Havana Street Railway, has been a victim of yellow fever, but we are pleased to learn that the crisis has been passed and that he is on the road to recovery.

Mr. D. M. Campbell, who has been for almost a decade foreman of the Ottawa Car Company's works at Ottawa, was on Christmas eve made the receipient of a beautiful case of drafting instruments by the employees under his supervision.

Mr. Alfred Fairbairn, of Montreal, has gone to Kingston, Jamaica, to accept the position of comptroller of the West India Street Railway Co. Before his departure some of his friends in Montreal presented him with a gold watch as a testimonial of esteem.

Mr. J. A. Kammerer, local manager at Toronto for the Royal Electric Co., of Montreal, was presented during the holidays with a handsomely framed group of portraits of the members of his staff, an enlarged photo of himself occupying the place of honor in the centre, and on either side photos of the interior of the Cataract Power Company's generating station at DeCew Falls.

Mr. F.C. Armstrong, well known throughout Canada as the former representative of the Canadian General Electric Co., spent the holidays among his Canadian friends. Mr. Armstrong now occupies the responsible position of manager of the commercial department of the well-known engineering firm of Dick, Kerr & Co., London, England, of which Mr. Rutherford, formerly chief engineer of the Canadian General Electric Co., is now the general manager. Mr. Rutherford is at present in India in connection with some important project in which his firm are interested. It is gratifying to be able thus to record the success achieved by Canadians abroad.

The contract for lighting the streets of Dartmouth, N. S., by electricity expires in June next, and the council will shortly consider the question of renewing the contract or installing a municipal plant.

REGULATIONS CONCERNING ELECTRICAL APPARATUS.

A COMMITTEE of the British House of Commons appointed to enquire into certain dangerous trades made a somewhat comprehensive report regarding the dangers incidental to the operation of electrical generating works. After describing the process of generating and distributing electricity, the committee recommended that the following regulations be adopted for the protection of apparatus in stations where current is generated at a pressure above 700 volts direct or 350 volts alternating :

1. The frames and bed plates of all generating machines shall be efficiently connected to earth.

2. The rails fencing dynamos, or other generating machines, shall be made of wood or other non-conducting material.

3. All terminals, collecting brushes, main connectors, parts of dynamos, motors or other appliances, to which neither regulation No. 6 nor No. 7 applies, shall be so placed, covered or fenced with non-conducting materials, that no person can touch accidentally, either with his body, clothing, or any conducting tool, two parts differing from each other by an amount which constitutes a high pressure. This rule is to be read in connection with No. 4.

4. The floors of all places where it would be possible to make connection with metal at high pressure shall be covered with an insulating mat of suitable material and kept in a state of efficient insulation.

5. The material used for wiping or cleaning the commutator strips or collector rings of dynamos, motors, or rotary converters of any form shall be applied by means of an insulating handle.

6. In switchrooms and on the front of switchboards, the main switches, main fuses, main terminals, omnibus bars, and all other metallic parts shall be insulated or arranged in such manner as to render it impossible for any person by accident or inadvertence to touch them.

7. The backs of all switchboards shall be kept closed, except for the purpose of alterations or repairs. When such work has to be carried on either at the back or at the front of switchboards, the following regulations shall apply :

a. No person except a skilled electrician, or a workman under his personal and immediate supervision, shall be employed when any part is at high pressure.

b. No extensive or serious repairs shall be executed upon metal which is at high pressure.

c. Where the alterations or repairs are not of an extensive or serious character, all metallic parts at high pressure shall be covered with an insulating cap or protected by some form of insulating covering, only one part, or several at the same pressure, to be exposed.

8. All switchboards erected after the application of these rules shall have, at the back, a clear space of at least four feet. This space shall not be utilized as a store room or lumher room, or be obstructed in any manner.

9. Any person at work upon a cable or portion of the mains under high pressure shall wear india rubber gloves on both hands.

10. All aerial high pressure conductors in factories or workshops shall either be insulated over their entire length, and supported at such frequent intervals, that, in the event of breakage, they shall not come within reach at places where persons are liable to pass or to be employed, or shall be so placed and arranged as to comply with the requirements relating to such wires in streets enjoined by the Board of Trade.

11. The gloves shall be supplied by the occupier, and it shall be the duty of the manager to see that they are in a proper state of repair, and are worn by the work-people.

12. No examinations, repairs, or alterations necessitating the handling of mains, wires, machines, or other apparatus shall be carried on except in cases of urgent necessity while such parts are under high pressure, and all such work shall be done under the personal supervision of an electrical engineer or competent manager or foreman.

13. Where operations are being conducted upon mains from which the current has been cut off, the switch shall be locked and precautions taken that it shall not be unlocked except by the person in charge of the station on his being satisfied that the danger is at an end.

14. Every vessel used for lubricating purposes shall be so constructed that it cannot act as a conductor between the hand and anything touched.

15. Metal transformer boxes shall be efficiently connected to earth, and so constructed that in the event of "running to frame" the earth connection will not be broken by the removal of the fuse box or any other part of the box.

16. Transformer cases, iron ladders, and all permanent metallic parts contained within the transformer chamber, and not forming part of the electric circuit, shall be metallically connected together.

17. All holes in transformer cases, through which high pressure conductors pass, shall be lined or bushed with suitable and effective non-conducting material.

18. All high pressure connections within a transformer chamber shall be so protected with insulating material that it shall be impossible to touch them.

19. Switches which can be conveniently operated from the outside for cutting off both the high and low pressure connections of the transformers shall be fitted in all transformer chambers erected after the application of these rules, and in all existing chambers, unless it is proved to the satisfaction of Her Majesty's chief inspector of factories that such an arrangement would be attended by special difficulty.

20. Each post or support where series arc lighting is employed shall be provided with means for completely disconnecting the arc lamps from the mains, without disturbing the action of the other lamps.

DECISION AFFECTING LIGHTING FRANCHISE.

A MOST important judgment has been handed out by the court of appeal at Montreal. The decision was in regard to an action for $20,000 damages brought by the Hull Electric Company against the Ottawa Electric Company. The facts in the case are: The Hull Electric Company got a charter in 1894 based on a by-law of the city of Hull purporting to give to it the exclusive right of supplying electric light, power and heat within the limits of that corporation. At that time the Ottawa Electric Company had been located in Hull, and doing business there, for six or seven years under a privilege that it did not deem as exclusive. The Hull company then set up the claim that the Ottawa company was doing business in that city contrary to its charter, maintaining that it alone had the right to do business in Hull. When no attention was paid to this assumption, the Hull company brought action for damages and to have it declared that it had an exclusive privilege ; also to compel the Ottuwa company to take down its electric system and cease to do business in Hull. The Ottawa company pleaded in answer that the charter of the Hull company was not exclusive, that it had a right to continue to do business in Hull, and that it was not responsible in damages. The Ottawa company also ponted out that it was not within the power of the legislature of the province of Quebec, from which the Hull company's franchise had been obtained, to grant an exclusive franchise to any company ; that the Dominion parliament alone had the power, under the B.N.A. act, to grant an exclusive franchise of the kind in question. Judge Lavergne held that the provincial legislature of Quebec had no right to give an exclusive franchise, and that consequently the action of the Hull company was unfounded. The case was dismissed with costs against the Hull company. From this judgment the Hull company appealed to the Court of Revision at Montreal, there being on the bench Sir Melborne Tait, Judge Pagnuelo and Judge Gill. This court reversed the decision of Judge Lavergne. The Ottawa company then in turn appealed to the court of appeal in the same city, and judgment, as has been stated, was rendered restoring Judge Lavergne's decision. Presiding were Sir Alexander Le Coste, Judge Bosse, Judge Blanchet, Judge Hull and Judge Wurtell. There were three parties to the action. The corporation of the city of Hull took sides for the Ottawa company, and appeared, through the medium of its legal representative, to uphold the position that it had not in fact granted an exclusive franchise and never intended that the Hull company should have an exclusive privilege.

It is probable that the latter will now carry the case either to the supreme court or to the privy council. If the court of appeal's judgment is sustained the Hull council will be enabled to establish a civic lighting system, which otherwise it will not have power to do.

The Toronto Rubber Shoe Company, of Port Dalhousie, Ont., are installing in their new factory a 150 k.w. S.K.C. two phase generator, with switchboard, and one 30 h.p. and one 7 h.p. S.K.C. two phase induction motors. The entire factory will be lighted and operated by electricity.

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Telephone and Phonograph.

A YOUNG man named Paulsen, son of a wealthy lawyer of Copenhagen, Denmark, is said to have invented a phonograph, designed to be operated in conjunction with the telephone, and which will record with a magnetic needle the message delivered to the telephone. If desired the phonograph can be disconnected from the telephone. The method of operation of the new invention is thus briefly described: "A very small magnetic needle, which is influenced by the current of the telephone wire, governs a steel ribbon which in turn runs over two cylinders. These cylinders come in touch with the magnetic needle and the work is done. While the instrument is operating and a person talks into the telephone, the magnetism in the steel ribbon is influenced by the electric needle to such a degree that a perfect message is recorded. At the receiving end it is only necessary to let the steel ribbons pass later before the electric needle and the current will then reproduce the words sent over the wire. Just as soon as the message has been heard, by passing a magnet over the steel ribbon, the speech is wiped off immediately and the instrument is ready to receive messages again." A company has been formed to introduce the invention throughout the world.

Destructive Effects of Earth Currents.

ENGINEERING, of London, in a recent article, refers to the disturbance caused at St. John's College, Oxford, by stray currents emanating from dynamos in the building. Reference is also made to the Toronto Observatory, where the delicate recording mechanism was so seriously affected by the current employed on the street railway lines 700 feet distant, that removal to a new location several miles east of the city became necessary. In the construction of the new building the stone was mechanically tested, blocks showing traces of iron being rejected. In the Cavendish laboratory at Cambridge, even the hot water pipes are made of copper. Notwithstanding every precaution, however, it is stated that several of the prominent observatories, including the national institution at Greenwich, are seriously affected. The most certain remedy, although a costly one, is that adopted by the Toronto Observatory. The purpose of the Toronto Railway Co. to weld together the ends of the rails throughout their entire system, should greatly lessen the escape to earth of return currents and the destructive effects of the same. Engineering suggests that a remedy may also be found in the use of aluminum conductors, but of this we are not sanguine, as aluminum is not well adapted for use in cities, where the injury from earth currents is greatest.

Electrical Progress in 1899.

ENQUIRY reveals the fact that the electrical industry in Canada shared to the full in the prosperity and development which characterized nearly every department of commerce and industry during the year which has just closed. The leading electrical manufacturing and supply companies report that the volume of their business for 1899 exceeded by upwards of 75 per cent. the business done during 1898. More than half of the output of these companies was applied to the extension and improvement of existing plants, the bulk of the machinery sold being for lighting and power purposes. There was but little new railway construction work done during the year, but considerable apparatus was required for extensions and improvements to the street railways in Toronto, Montreal and Winnipeg. Many electric lighting companies took advantage of the prosperous times to discard old type machinery and replace the same with new apparatus of higher efficiency. In most instances, larger units were installed and the old type machines kept on the premises to be used as a reserve in case of emergency. As a result of the unusually large business done, the stock of the two leading manufacturing companies has risen fifty points during the year, and further advances are predicted. The workshops of the electrical manufacturing companies are said to be crowded with orders to such an extent that no promise of delivery at a specified time can be made and prices are firmly maintained. The outlook for the new year is also very promising. On good authority we learn that during this year nearly 100 miles of electric railway will be built out of the city of Hamilton. Canada can already boast of having in operation the largest generators in the world, and to be the home of some of the largest electrical enterprises in the world, and there is reason for the belief that the limit in this direction has not yet been reached.

Opposition to Electric Railways.

The construction of electric railways through rural districts has brought into prominence the question of what conditions should govern the operation of these roads. In the discussion of this question, opportunity has been taken by certain public men to criticise rather severely the operating methods adopted by street railway companies. The Toronto Railway Co., for instance, have been condemned for what is claimed to be their neglect in not providing an efficient fender. A criminal action has been taken by the Crown against the officers of the company and the City Engineer, on account of the killing of a person while crossing in a sleigh a street intersection. The verdict of the Coroner's jury states that the fender in use was not the best available, and that the speed of the car was so great as to be inconsistent with safety to life. That it is now possible to obtain a more efficient fender than those in use the company admit, but they claim that the present fender was the best that was available when it was introduced, and that since having adopted it they have been endeavoring to satisfy themselves as to the efficiency of the various fenders on the market. The question as to what fender to adopt has been given much consideration by street railway companies both in Canada and the United States. A deputation of the Montreal Railway Company recently visited many of the leading cities in the Eastern States for the purpose of investigating the merits of the various fenders in use, and subsequently recommended the adoption of the fender invented by Mr. Geo. Sleeman, of Guelph. This fender is now used by the Montreal, Winnipeg and Guelph street railway companies, and has, we believe, been quite effective in the prevention of fatal accidents. It has been suggested that a government commission be appointed to make an investigation and report as to the most efficient fender to be employed. This course would no doubt meet with the approval of street railway companies, who would not likely be slow to act upon the recommendations made. It is being urged in some quarters that a line of policy towards electric railways, covering such points as rights of way on public thoroughfares, duration of franchises, fares, connections with other roads, and similar matters, should be declared by the government, and that a commission or arbitration board should be appointed to decide matters in dispute. No section of the community would welcome such a policy more heartily than the railway companies, as they would then know exactly on what ground they stood. A point to be guarded against, however, is the placing of such restrictions upon the operation of electric railways as would retard their development. In this connection it might not be amiss to point out to the electric railway companies the necessity of organization, to more effectually present their just claims to the public authorities, and to prevent the adoption of legislation based on erroneous assumption.

Death from Electric Shock.

Dr. Cunningham contributes to the Electrical World a valuable treatise giving a description of how electric currents induce death in the lower animals, as well as his observations regarding effect of such currents upon the human body. Dr. Cunningham has devoted much study to this subject, and has made exhaustive experiments on dogs, with currents at more than 1,000 volts pressure. To ascertain the effect, currents were passed for various periods of time across the chest, through the brain, and from the brain to the thighs. He found that when the chest was transversed by a current for a sufficient length of time the effect was the immediate cessation of the heart action. The circulation of the blood throughout the body ceased and the nerve cells of the system died rapidly from the lack of indispensable blood. When the circuit included the heart and the brain a combined effect was the result, the heart being thrown into fibrillation and the blood supply to the brain ceasing. Death is thus produced by disorganizing the action of the heart. Dr. Cunningham is of the opinion that artificial respiration, if applied at once, would in the majority of cases restore life, but that if many seconds elapse the co-ordinate heart beat would fail to reappear. He suggests that the required stimulus might possibly be given by a high pressure electric shock. This method of resusitation might be employed on the lower animals, but it would require considerable persuasion to induce the friends of a person injured by an electric shock to apply as a restorative the agent which was responsible for his injured condition. Dr. Cunningham is of the opinion that electric currents act on the human body in the same manner as they do on the canine race. Altogether, his experiments are not favorable to resusitation in the event of a shock from a high pressure current.

Electric Light Inspection.

By the annual report of the Inland Revenue Department of the Dominion for the year ended June 30th, 1899, we are furnished with some particulars regarding the working of the Electric Light Inspection Act, authorized by Parliament in the spring of 1894 and put into effect in June of the following year. There were registered under the Act during last year 276 companies, who paid in registration fees the sum of $4,170. These companies have in operation 10,960 arc lamps and 546,672 incandescent lamps, or, calculating that one arc is equal to ten incandescents, a total capacity equal to 656,200 incandescent lamps. Comparing these figures with the number of lamps in use three years ago, they show a substantial growth of the electric lighting industry. During the year ended June 30th last there were presented for inspection 5,762 electric light meters, of which 5,566 were accepted as correct or as coming within the limit of error permitted by law. There were rejected 187 meters, but 134 of these were verified after first rejection. The fees charged for the inspection of meters were $7,228.25, or about $1.35 per meter. It will be observed that the revenue for the year from registration and inspection fees reached a total of $11,398.25. The expenses of inspection are given as $4,007.02, leaving a balance of $7,391.23. There was expended on standard instruments the sum of $2,625.67. These instruments, we presume, are in a measure a permanent asset, and should not be charged against the expenses of any particular year. But, even after allowing a sum to cover the cost of these instruments, it is shown that there was a net revenue derived from the inspection of electric light in the year under review of $4,675.56. Clause 26 of the Electric Light Inspection Act states that the fees shall be regulated so that they will, as nearly as may be, meet the cost of carrying the Act into effect. It apparently was not the intention of the Act that its operation should in any way increase the government revenue. It would seem, therefore, that the time has arrived when a reduction of the fees charged would be in order. It is indeed a strange anomaly that the electric lighting companies should be called upon to carry a portion of the expense of the inspection of gas and weights and measures. We observe that while the fees for the inspection of electric light are more than double the expenses, the revenue obtained from gas companies is between one and two thousand dollars less than the expenditure, while for the inspection of weights and measures the revenue for the year was $48,453.95, against an expenditure of $63,643.31. The comparison is certainly not such as will meet with the approval of the electric lighting companies of Canada.

MR. A. F. NASH.

As previously announced in the Electrical News, Mr. A. F. Nash, of Windsor, Ont., has been appointed to succeed the late Mr. Williams as electric light and gas inspector for the London district. Mr. Nash was born on June 22, 1853, in the town of Whitby, Ont., securing his first business experience with the firm of Thompson, Smith & Son, lumber dealers, of Toronto. From 1870 to 1876 he was employed in their Oswego office. In January of the latter year he became associated with his brother, Mr. C. H. Nash, who during the previous season had erected the Stratford gas works. He assisted in the construction of the Napanee gas works, and subsequently accepted the management of the Stratford gas works, being appointed secretary-treasurer of the company in July, 1877. Four years later he resigned this position and removed to Windsor, where he held a similar position until February, 1882, when he removed to St. Joseph, Mo., and became secretary-treasurer of the St. Joseph Gas Co. In April, 1887, he returned to Windsor to become manager of the Windsor Gas Co.

During the summer of 1887 Mr. Nash installed an arc light plant in conjunction with the gas works, which he operated until December, 1890, when a municipal plant having been installed by the city, he was compelled to shut down his plant and dispose of it piecemeal as opportunity presented. This was his reward for providing electric lighting for the city when that industry was almost in its experimental stage. Mr. Nash continued as manager of the gas company until March, 1896, when, owing to a change of ownership, he resigned his position. His next appointment was as eleatric light and gas inspector for the London district, the duties of which office he is well qualified to discharge in the intetests both of the government and the lighting companies.

QUESTIONS AND ANSWERS.

A subscriber writes from a town in Western Ontario as follows :—(1) "I am in charge of the lighting plant here and have worked myself into a small corner with the series street lighting, but yet I believe that I am all right, but to make sure am bothering you. There are installed and burning 56 street lamps, 32 c.p., and what are called 45 volt lamps, on two circuits. One circuit has 27 lamps, the other 29 lamps, with a booster. I want to add 10 more lamps—they are scattered all over the two circuits—and at the same time do away with the booster. The way I figured, also where I made the mistake, was as follows : Assuming my primary voltage at 1,000 volts and the lamps each taking 45 volts, and 56 lamps already burning, with the ten new ones make $56 \times 10 = 66$; then in going over my lines outside, I found that I could divide them up into three circuits with very little labor and expense, which would give me three circuits containing 22 lamps each, $66 \div 3 = 22$, and 1,000 v. ÷ 22 l. = 55, which would allow me to divide that way, and only leave 10 volts over. But upon considering my plan I found that my primary voltage was nearer 1,150 than 1,000, for my secondary voltage is 115 volts. What I want to know is this—can I safely do this yet—put 22 lamps in series, they being only 45 volt lamps, or will it just blow them all out of business? They are the Buckeye lamp, and as they are running give a poor light. I don't think they are developing their full candle power." (2) "I would also like to ask some of your readers what they would consider a fair consumption of coal for a plant consisting of a boiler 60″ × 14′, well placed, burning mine run coal ; boiler feed ; a duplex steam pump feeding through a heater capable of raising temperature from 50° to 190° F.; engine 13 × 30, high pressure Wheelock (steam pipe covered), running an alternator (inductor) 10½ hours in two runs—first eight hours fires banked for 5½ hours, then 2½ hours run, and then fires banked again for eight hours ; average load 17·5 amperes.

Answer.—(1) This is a very simple problem. The 22 lamps would not have quite resistance enough to keep current down to normal. It would be necessary to put sufficient resistance into each circuit to equalize them with the pressure. In practice it will be a simple matter to put one or two extra lamps on to each circuit and cut them out one at a time till the required current was obtained. If there were then left more lamps in each circuit than were required outside, they could be utilized to light the plant. This would be better than wasting the current in a rheostat. (2) From three-quarters to one ton per day, depending on quality of coal and on a somewhat varying load.

A CANADIAN BOILER-MAKER.

Boiler-making, like its sister trade, engine-building, is a branch of industry which has commanded the attention and study of some of the most able men of the nineteenth century. The nature of the duty that a boiler is designed to perform renders it imperative that there should be identified with its construction artizans of recognized ability and skill. As one who has attained renown in this direction we introduce to readers of the ELECTRICAL NEWS Mr. J. J. Main, of Toronto, who is well known in engineering circles.

Born in one of the Channel Islands in the year 1852, Mr. Main came to Canada with his parents when but a boy, obtaining his early education at public schools at Montreal and Barrie. At the age of 13 he was apprenticed to learn the trade of a mechanical engineer, but disliking his position and the hours he was required to work, namely, from 4 o'clock in the morning till 9 at night, he decided to seek other employment. He became apprenticed to the boiler-making in the Northern Railway shops at Toronto, and while thus engaged attended the Mechanics' Institute night school, where he received tuition in drawing and mathematics at the expense of Mr. Cumberland, managing director of the Northern Railway Company, who had recognized him as a diligent and faithful employee. After completing his apprenticeship Mr. Main joined his father in taking contracts for points, crossings, etc., for the narrow gauge railways, their shops being located just on the site where the large chimney of the Toronto Railway Company's power house now stands.

Towards the close of the year 1870 the boiler-making trade began to improve, and Mr. Main engaged as a journeyman with Dickey, Neil & Co., whose works were located on Beverley street, Toronto. The business of this firm was confined largely to the building of boilers for the oil wells in western Ontario and for saw-milling plants, the manufacture of marine boilers being well nigh controlled by Neil Curry, whose works were on the Esplanade. The marine boilers of those days were of the fire-box return tubular, low pressure steam chimney type.

It is only when we compare the primitive methods then employed with the equipment of a modern boiler-making plant of to-day that we can appreciate to the full extent the difficulties under which the artizan labored in earlier days. Mr. Main states that a boiler which thirty years ago would require one year in which to build could now be completed in two months. The shops of Dickey, Neil & Company were so small that it was frequently found necessary to remove one side of the shop in order to get a boiler out. Any kind of a building was considered as good enough for a boiler shop. Anything but a mud floor was unknown, and in many cases there was little roof, and the workman frequently had to shovel the snow off his work and tools on winter mornings. The drilling of holes in boiler plate was regarded as an impossibility. Whenever they could not be punched with a punching machine they were cut with the hammer and chisel. The chief qualification of a boiler-maker consisted in his ability to cut a large number of holes in a day.

MR. J. J. MAIN.

Mr. Main remained with Dickey, Neil & Co. for two years, then went to the United States for a similar period, working as journeyman in Titusville, Oil City and Pittsburg on boilers for oil wells and stills. It was there that he gained valuable experience in doing rapid work. Returning to Toronto in 1874, he engaged with Irwin & Marshall, who conducted boiler and engine works on the Esplanade, between Jarvis and George streets. While thus employed he had the honor of building the first steel boilers built in Toronto, while but comparatively few had previously been built on the Continent. These boilers were 6 feet 4 inches in diameter and 16 feet long, and were then considered exceedingly large. They are still in service at the Toronto Waterworks. While with this firm Mr. Main also built boilers for the Toronto University. These were made of Swedish iron, but investigation proved that it was practically the same class of material as the steel used in the boilers for the Toronto Waterworks, and which was furnished by the Otis Steel Company, of Cleveland, Ohio.

In the spring of 1876 the subject of our sketch went to Erie City, Pa., in the capacity of foreman for the Erie City Iron Works. It was there his privilege to operate one of the first flanging machines built in the country. Flanging, it might be explained, is one of the most important branches of boiler-making, and Mr. Main had obtained a reputation for rapidity and efficiency in this direction. In 1877 he returned to Canada, engaging with Inglis & Hunter, machinists and boiler makers, of Guelph, as foreman. There he remained until 1880, when he again returned to Erie City, securing a more lucrative position. After a period of sixteen months he was induced to return to Canada and assume charge of the new works of Inglis & Hunter about to be established in Toronto. While thus acting as superintendent, Mr. Main was also interested in the business, receiving a percentage on sales. He remained with this firm—in the meantime changed to John Inglis & Sons—until 1895. To him the credit is due of constructing the first large Scotch marine type boilers built in Canada. This was in the year 1892. They were 11 feet 2 inches in diameter and 11 feet long. They were first built in the shop, then taken down and removed in pieces to the boat in dry dock at Port Dalhousie, and then put together in place, practically turning the steamboat into a workshop. Mr. Main also enjoys the distinction of building the largest number of marine boilers on the lakes at the present time.

After working incessantly for thirty years, Mr. Main decided to take a holiday trip to Great Britain, but after having secured his passage on the steamer Vancouver, he was prevented from so doing through family illness. Mr. Main was about to engage in the manufacture of boilers on his own account, and had selected tools and site, but before arrangements were finally completed the Polson Iron Works Company, of Toronto, made him such a liberal and satisfactory offer that he engaged with them as superintendent of their boiler works. In the following year, 1896, in conjunction with Mr. James R. Annett, he purchased the right to manufacture in Canada the celebrated Heine patent safety water tube boiler. He now occupies a dual position, being superintendent of the Polson Boiler Works and superintendent and treasurer of the Canadian Heine Safety Boiler Company. The first contract secured by the latter company was for one boiler of 250 h.p. and three of 150 h.p. for the new municipal buildings in Toronto. The favor with which the Heine boiler has been received in Canada may be understood by mentioning some of the contracts secured by the company. In addition to the above contract, the following batteries of boilers have been installed: Temple building, Toronto, two boilers of 120 h.p. each; Toronto Electric Light Co., three of 260 h.p. each and two of 410 h.p. each, the latter being the largest water tube boilers in Canada; T. Eaton Co., Toronto, five of 150 h.p. each; Gutta Percha Rubber Co., Toronto, one of 260 h.p.; Macdonald Rolling Mills Co., for utilizing waste heat from blast furnace, one of 100 h.p.; Asylum for Insane, New Westminster, B.C., three of 60 h.p. each; Massey-Harris Co., Toronto, three of 200 h.p. each; Dominion Radiator Co., Toronto, one of 150 h.p.; Truth Publishing Co., Toronto, one of 150 h.p.; new La-Presse building, Montreal, two of 150 h.p. each; Central Prison, Toronto, one of 150 h.p.; Asylum for Idiots, Orillia, two of 150 h.p.; Crow's Nest Coal Co., Fernie, B.C., one of 200 h.p.; Lever Bros., Toronto, two of 260 h.p. each. These contracts represent a consideration of $100,000, a business for three years of which a new firm may justly feel proud.

Since assuming the superintendency of the Polson Boiler Works, Mr. Main has made many improvements in the plant. He was the first to introduce in Canada pneumatic machines for drilling, corking and rivetting boilers, and he has to-day at the Polson works a complete pneumatic as well as hydraulic plant. He was also the first to build in Canada large digestors for sulphite pulp mills, having just completed three for the Riordan Pulp Co., of Hawkesbury, Ont. Each digestor is 13 ft. 6 inches in diameter, 38 feet high, and they are known as eleven ton digestors, being capable of making eleven tons of pulp each charge. They are made of $1\frac{1}{8}''$ steel plate, with $1\frac{1}{4}''$ butt straps. A special press for forming the ends, which are elliptical in shape, was built by the Polson Company. It has a capacity of 100 tons, and cost about $10,000. One of Mr. Main's ingenious inventions is a furnace for heating the plate. It uses crude oil and compressed air, and is in the form of a large oven about 12 feet square. This press and furnace is also used for flanging and pressing large marine boiler heads.

As a boiler-maker Mr. Main is recognized as having few compeers. It is said of him that during his career he has turned out a greater number of tradesmen qualified to fill the position of foremen than any other boiler-maker in the Dominion. Many of his apprentices are now occupying responsible positions of this character. The secret of his success in this repect probably lies in his willingness and desire to impart information. This characteristic is in striking contrast with the policy pursued generally in earlier days and by some at the present time.

Mr. Main possesses an individuality that commands attention. He is popular with all who have his acquaintance or friendship, and many persons can testify of assistance in their work received at his hands. He is a man of broad mind, sound judgment and keen perception—qualities which go a long way to make a successful business man. In private life he is also much respected.

CHANGING THE TRANSFORMER VOLTAGE.

A CORRESPONDENT of the American Electrician asks the following question : How can I change a 50-volt transformer so that I can raise the voltage from 50 volts to 100 volts, i.e., so that I can make a step-up transformer which will raise the voltage from a 50-volt circuit to a 100-volt circuit.

The answer given is as follows : If the transformer you wish to change is fitted with two secondary coils which can be connected either in parallel for 50 volts or in series for 100 volts, it is a very simple matter to use them to transform from 50 volts to 100 volts without rewinding the transformer at all. This can be done by connecting the two secondaries in series for 100 volts and bringing out the middle point or common connection between the two coils ; the 50-volt circuit should then be connected between this middle point and one of the outside wires, and the 100-volt circuit can be taken off from the outside wires. The transformer will then be capable of transforming its rated load from 50 to 100 volts, even though half its wiring space, viz., that occupied by the primary, is idle. For instance, if the transformer is rated at 1 kilowatt it will transform 1 k.w. from 50 volts to 100 volts or from 100 volts to 50 volts without overheating. If, however, the transformer is designed to give only one voltage in the secondary, a different means must be adopted. If this voltage is 100 volts, the simplest means is to find if possible the middle turn of the secondary winding and tap this out for a 50-volt terminal, connecting up the instrument as described above. If the transformer is only wound for 50 volts, the primary coils should be removed and another coil, an exact duplicate of the secondary, i.e., with the same number of turns of the same size of wire, should be put on in place of the primary. These two coils should be connected in series and the 50 and 100-volt circuits connected to them, as described above. In this case a transformer rated at 1 k.w. would be able to transform 2 k.w. In all cases the 50-volt and 100-volt circuits should be electrically connected to each other, but this is, as a rule, no disadvantage in such low tensions.

INCANDESCENT ELECTRIC LAMPS.

AN important question in connection with the operation of electric lighting plants is that of the value and efficiency of various forms of incandescent lamps, and a valuable discussion of the relation between power consumed and illumination furnished forms the subject of a paper by Inspector Loch, in a recent issue of Glaser's Annalen.

The ordinary life of an incandescent lamp is placed at 800 to 1,000 hours, but this extreme duration of the filament is by no means the measure of its illuminating usefulness. The real point at issue is the maintenance of uniform illuminating power. In some instances lamps reach a life of 1,000 hours only with a great diminution in brilliancy, while in others a useful life of 3,000 to 4,000 hours has been attained.

As a rule those lamps which yield a brilliant light at first for a given consumption of electrical energy show also a more rapid falling off in brightness than those which start with a weaker light.

With the falling off in illuminating power there appears also an increase in the consumption of electrical energy. An average consumption for a new lamp is from 2 to 4 watts per Hefner candle while this may increase to 9 watts per candle before the lamp fails.

There is, however, a great difference in different lamps, even of the same makers. Lamps rated at 16 candles are found to vary between 10 and 30 candles, while 25 candle lamps may range from 15 to 50 candles. A moderate increase in pressure makes a marked increase in brilliancy, and hence Siemens & Halske stipulate for a variation in pressure of not more than 2 per cent. either way from the normal rating of their lamps, i. e., for a 16 candle lamp at 110 volts the pressure should not exceed 112 volts nor fall below 108 volts.

In order to investigate the subject fully, Herr Loch conducted a series of experiments upon a number of incandescent lamps, noting both the life and duration of brilliancy as well as the consumption of electrical energy, the results being plotted in the form of curves. The lamps for the tests were furnished by the makers in accordance with certain specifications, with the intention of securing, as nearly as possible, articles of normal character. Each lamp was required to be tested, and it stipulated that during the first twenty-four hours the illuminating power should not vary more than 6 per cent. either way from the normal, while each lamp was also obliged to stand a run at pressure 2 per cent. above and below the normal rating without showing injury. The normal consumption of energy was required to fall between the limits 2, 5 and 3.5 watts per candle, and the illuminating power must not fall more than 15 per cent. during the first 480 hours. At the end of this period it was also required that the consumption of electrical energy should not have increased more than 20 per cent. over that required at the beginning.

The records of the tests are given very fully in the article referred to, both graphically and in tabular form, and to the original publication the reader must be referred. The general conclusions, however, were altogether clear, and can readily be summed up.

The tests, as indicated above, were made for twenty-four hours in order to enable the preliminary measurements to be made, after which the 480 hour trial followed, and such lamps as survived were then continued on trial until a total 960 hours had been completed.

The general result of the investigation showed that the consumption of electrical energy continued about the same per lamp throughout the entire test, having fallen off but slightly at the termination of 960 hours, but the illuminating power diminished steadily during the same time, so that the power per candle increased materially ; in one case the energy per candle increasing from 2.45 watts to 6.75 watts, the candle power having fallen from 24 to 8 during the run of 960 hours.

These evidences of deterioration in incandescent electric lamps correspond to a great extent to those which have been noted in connection with incandescent mantles for gas lamps. A similar falling-off in illuminating power is observed, while the consumption of gas remains the same and hence the efficiency is reduced. It is evidently in the interests of economy to observe the performance of both kinds of lamps and replace them before the waste becomes excessive.—Engineering Magazine.

INVENTION OF COMBINED GAS AND STEAM ENGINE CLAIMED.

THE problem of the transformation of heat into mechanical energy in an economical manner has been a perplexing one since the advent of mechanical power. Professor V. H. Emerson, mechanical and civil engineer, an American citizen at present residing in Ottawa, Ont., who has established a reputation in Canada through his recent discovery of a process for the conversion of sawdust and sawmill refuse into calcium carbide for the production of acetylene gas, claims to have taken very important steps in solving the problem, and he has in operation a powerful and compact machine which he terms a hydro-electric motor, inasmuch as the motor is composed of a number of elements, in which water and electricity form prominent parts. In respect to his new discovery, Professor Emerson, when questioned, said :

"I cannot go into the structural details concerning the motor, as I have not yet secured patents. I have designed the machine for operating my carbonizing machinery, of which I expect to install plants throughout the country. The motor may be used for many other purposes, such as operating street cars, boats, supplying electric light or pumping water for private residences, and as a motive power for vehicles ; in fact, in any place where a powerful motor of light weight is required. A 10 horse power motor, as constructed for a carriage or boat, would not exceed 125 pounds in weight, and the two horse power machine I now have in operation weighs 46 pounds, but in this I have not attempted to reduce the weight. The motor operates at a moment's notice by connecting a lever with a key, which puts an electric battery in circuit, and it is as easily controlled as a steam engine ; in fact, when once started, requires no further attention.

"The principle upon which my motor operates is equivalent to building a fire directly in a vessel of water ; the water, taking up the entire heat, becomes expanded into steam, and thus produces mechanical energy by so doing. The hot gases escaping from the smokestack of a steam boiler or the high temperature of the exhaust of a gas engine is entirely obviated by my system of motor, and it will exceed in point of economy more than 50 per cent. of the best steam engine practice.

"In order that the operation may be more thoroughly understood, I may state that atmospheric air is charged with carbonaceous matter. This mixture is ignited by an electric current, producing expansion and a high temperature. At this instant it is brought into contact with water, broken into minute proportions, the water being converted into vapor instantaneously, which reduces the temperature and increases the pressure, which acts upon a piston and is converted into mechanical power. The whole operation is automatic and continuous, and we have practically a steam engine without a boiler or exhaust steam.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, January 5, 1900.

It is rumored that the Bell Telephone Company will enter suit against certain local manufacturers of 'phones on the ground of patent infringements.

The Royal Electric Company have lost the work they were tendering for at the Paris Exhibition, it being given to a Parisian company for some three thousand dollars less.

Ottawa people are discussing the question whether carbide works are or are not dangerous. The burned victims of the explosion the other day would seem to be exhibits of the affirmative side.—Gazette.

To give an alarm when the speed of motor cars is too great a small dynamo is used to generate power, with an armature set to respond at a predetermined speed of the dynamo, ringing an electric bell as soon as the abnormal speed is reached.—Exchange.

The Montreal Electric Company report the sale of a 55 k.w. multipolar Crocker-Wheeler generator to the Mechants Cotton Company for lighting purposes. This displaces two small units in old mill. An 18 station Eco Watchman's magneto time detector will be installed in the mill by the above company.

Some very nice decorating has been done in this city with electric incandescent lamps, notably at the Royal Victoria Hospital (indoors), where the arrangement was under the supervision of their chief resident engineer, Mr. Bowden, on whom it reflects great credit. This was on the occasion of their usual Xmas festivities.

In the case of the Quebec Railway, Light & Power Company vs. the Jacques Cartier Water Power Company, for $25,000 damages, and the issue of a writ of prohibition, the defence have filed their statement of defence at Quebec, in which they claim that the action is not instituted on good faith, but simply to harass, molest and annoy defendants in their work.

The open winter season so far has been a perfect "picnic" for water power companies. As both the large Montreal concerns are now on that basis (admitted both have steam reserve), the present winter, when it gets properly to work, will have the deciding of a great part of next spring's contracts. The one who has least trouble, or gets out of it the quickest, thus providing the most constant service, will be sure to be the favorite.

A discontinuance has been filed of the suit of the Royal Electric Company against the Chambly Power Company and certain directors thereof. This action arose out of a dispute in which the transfer of certain stock and the legality of acts of the directors of the Chambly Company was called in question. It caused considerable excitement in stock exchange and business circles. Efforts to effect a settlement were eventually brought to an issue.

The various correspondence schools in the neighboring republic have been actively canvassing in Montreal of late, and have done good business, one in particular reaping a regular harvest of students. If some of these would so arrange their electrical course as to eliminate the dry mathematics and preliminaries and get right at electricity, they would capture a lot of former college students now in employment. It is to be remembered that when these went through college they had not in their time the practical course provided to-day, and were thoroughly "grounded" in mathematics, etc., "ad nauseam," for over three years of a probable four year course, consequently they look with awe at having to digest these over again before getting the food for which they hunger.

The McCarthy Brewery Company, of Prescott, Ont., are installing a lighting system in their brewery at Prescott, using the Canadian General Electric Company's apparatus.

The British Columbia Electric Railway Company have just installed in their new power house a new engine manufactured by the Laurie Engine Company, of Montreal. The diameter of the high pressure cylinders is 20 inches and that of the low pressure 40 inches, the stroke being 42 inches. The company are also installing one 500 k.w. generator of the direct connected type for street railway work, furnished by the Canadian General Electric Company, as well as a lighting machine from the Westinghouse Company, of Pittsburg.

TELEGRAPH and TELEPHONE

THE INVENTOR OF WIRELESS TELEGRAPHY.

A LECTURE was recently delivered at the Canadian Institute, in Toronto, by Mr. C. A. Chant, lecturer on Physics at the University of Toronto, the subject being "Wireless Telegraphy." Mr. Chant claimed that Marconi is not entitled to, and, indeed, has never claimed the glory which has accrued to him in popular report. Long before Marconi's time the ideas which he has since worked out were well known among investigators. Farraday was the first to direct scientific thought along the path which has led to present results. After him came Lodge, Maxwell, and a number of others, each contributing his quota to the sum of knowledge on the subject. Mr. Chant illustrated the various steps in the progress of knowledge by a number of interesting electrical experiments. The chief merit of Marconi, he says, lies in the idea of stringing a wire to a high mast, thus greatly increasing the distance over which the system can be operated. Previously the great difficulty in using it over long distances was that where the current encountered any obstacle, such as was presented by the curvature of the earth, it was sure to be dissipated. The high mast, with the attached wire, obviates this to some extent.

In making the wireless current of practical value, Marconi has been greatly aided by Mr. Preece, superintendent of the telegraph system in England, without whose energy the whole thing might still have remained in the theoretical stage. Mr. Chant expressed doubts as to whether it would ever be possible to send messages in this way across the ocean, although, as he pointed out, it is necessary to speak with much caution of anything relating to the advance of electrical science.

As to its use in war, he explained that one great difficulty is that no method has yet been devised of keeping messages secret. The current radiates in all directions, and can be read by anybody who is provided with suitable instruments.

THE G.N.W. TELEGRAPH CO.

AN unusual amount of construction work was done during 1899 by the Great North-Western Telegraph Company. A considerable portion of this work was made necessary by the great sleet storm of January, 1899. The systems in Hamilton, St. Catharines, Stratford, St. Marys, and other towns in western Ontario have been re-constructed, also 85 miles of line between Windsor and Glencoe. Considerable extensions were constructed in Manitoba following extensions of the Northern Pacific Railway, and, in addition, existing lines have been greatly improved. Upwards of 80 miles of new line have been built during the year on the line of the Great Northern Railway now in process of construction between Hawkesbury, Ont., and the city of Quebec. There remains about an equal amount of construction to be carried out. The volume of business done by the company during the year was largely in excess of any previous years in recent times, and the outlook is regarded as most satisfactory.

The New Brunswick Telephone Company will run a wire from Chatham to Fredericton.

ENGINEERING and MECHANICS

HAMILTON STATIONARY ENGINEERS.

THE Hamilton branch of the Canadian Association of Stationary Engineers held its monthly educational meeting on Tuesday, December 19th. Another of the series of papers on mathematics was read by Mr. C. R. T. Fessenden, the subject being "Signs and Symbols Used in Formulas."

In opening, it was stated that the modern engineer found it necessary to be almost constantly using rules in connection with his work. He said: A formula is merely a short way of expressing a rule by means of letters or signs, and arranges the rule in such a way that by merely writing the quantities, represented in the formula by letters, in place of these letters, we have only to perform the indicated operations to obtain our answer. In working out these rules we add, subtract, multiply and divide, find power and roots, and in the formula we indicate the operations by the following signs: The plus sign shows that the expressions between which it is placed are to be added, as $4+2$, meaning the sum of 4 and 2, and $A+B$ would mean the sum of the quantities for which A and B stand. The minus sign between two expressions indicates that the second is to be taken away or subtracted from the first; in $A-B$ the quantity for which B stands is subtracted from that for which A stands. The multiplication sign shows that the quantities are to be multiplied together, $A \times B$ or A B meaning that the quanities represented by the letters are to be multiplied. Letters written together as above, A B, with no sign between them, are to be multiplied, the sign being omitted for convenience. The dividing sign indicates the first quantity divided by the second, as $4 \div 2$ means 4 divided by 2; 4/2 and $\frac{4}{2}$ also read 4 divided by 2, the quantity to the left or above being divided by that to the right or below. $A \div B$, A/B and $\frac{A}{B}$ all mean quantity represented by A divided by that represented by B.

The power to which a number or quantity is to be raised is shown by placing a small number above and to the right of that number or quantity; thus 5^3 means 5 cubed, and means the product of 5 taken three times as a factor, $5 \times 5 \times 5$. A^2 means the value of A multiplied by itself; thus $A \times A$. The radix shows the root of a number used alone, and means the square root. Any other root is shown by the number placed in the V of the sign.

These signs have also further use in particular cases; the signs (+) and (−) separate expressions, and all quantities and operations between these lines, should be performed before the value of the expression is added or subtracted. The signs (×) and (÷) connect only the quantities on each side of them.

There are also other symbols used to shorten work by indicating the same operation on a number of quantities. These are generally called brackets, and all quantities and operations enclosed in them must be simplified or performed before proceeding. A number is sometimes written against the outside of a bracket, in which case the sign of multiplication is always understood. We have also the sign =, meaning equal to, and shows that the two quantities have the same value.

Formulas are generally given in the shape of an equation; that is, certain letters and operations equal some other letter. Below the formula is written that for which each letter stands; so, in order to work a formula, we take the quantity represented by a letter and place it in that letter's position in the formula, then perform the operation indicated, and the result obtained represents the other side of the equation or formula. Example:—

H.P. formula $\frac{P\,L\,A\,N}{33{,}000} = H/P$

Take a 14" × 40", running 75 rev. per minute. Mean effective pressure is average pressure throughout stroke as found by planimeter, 50 lbs.

A = Area of piston.
P = Mean effective pressure.
L = Stroke in feet.
N = Number of stroke = 2 revolutions per minute.

$$\text{Substitute } \frac{50 \times 154 \times \frac{40}{12} \times 150}{33{,}000} = 116.6 \text{ H/P.}$$

$A = 14^2 \times 7{,}854 = 154$ sq.—nearly.
$L = \frac{40}{12}$ feet.
$N = 75 \times 2 = 150$.

Before the meeting closed a hearty vote of thanks was tendered Mr. Fessenden for the excellence of his paper and for the intelligent and satisfactory manner in which he had explained the subject to the members.

It was announced that the subject for next month's meeting would be a paper on friction.

PUMPING MACHINERY.*

By C. E. MORGAN.

PERHAPS the engineer in his varied experience with machinery has given but little thought to the important work that a steam pump is called upon to perform in connection with his boiler plant. I would commence by stating that although it is possible to feed a boiler with other appliances, the steam pump undoubtedly is the best, all round, commercial article.

I do not propose to enter into the question of economy of the steam pump as compared with other means of feeding boilers, such as injectors and power pumps; these no doubt have their uses as auxiliaries, and perhaps in some cases it is advantageous to use a power pump where the engine or prime mover is constantly running, as by so doing the water is pumped practically with the economy of the engine. A boiler feed pump is called upon frequently to handle water at various degrees of temperature, and this being the case, certain mechanical features in connection with its construction have to be considered. For instance, in handling water at normal temperature, say 70 degrees, the ordinary inside plunger type of pump is perhaps all that is desired, whereas should the water reach a temperature of 212 degrees the conditions are different, inasmuch as the temperature of the feed water expands all working parts of the pump and it becomes necessary to have the machine so arranged that the water piston can be adjusted to meet these conditions. This feature is easily taken care of by using a special boiler feed pump, so constructed that its plungers are externally packed. This enables the engineer to immediately discern any leak which may have taken place and to satisfy himself that the pump is fully efficient at every stroke.

Some engineers have raised the objection to a certain amount of friction which is set up by the external adjustment of the plungers, but if the machine is properly made with deep well fitting neck bushes and glands, this feature is not of very much consideration, as under absolute test the friction set up is a very small percentage.

Difficulty is often experienced when pumps are working on very hot water, but in cases that have come under my own notice, I have usually found that the trouble has arisen by the machine being placed in a position where it would practically have to raise the water by suction, while, in place of this, it should gravitate, as the formation of a vacuum in pump would be immediately filled by the vapor from the hot water and would consequently interfere with the proper working of the machine. It is also very important to have valves of proper materials for handling water at high temperatures. Machines are frequently condemned when really the working parts are at fault.

In steam plants it sometimes happens that in feeding boilers the pumps used are much too small for the work required. In making a choice of a steam pump for feeding boilers it is well to have it of sufficient size so that it will do its work easily. For pumps having 4" stroke it is possible to run them to 150 strokes per minute; 6" stroke, 130; 8" stroke, 120; 12" stroke, 100; 16" stroke, 85; 18" stroke, 80. You will note that these are maximum speeds, and for boiler feeding purposes the machine should operate at about one-fourth of the above speeds. In estimating the capacity of the boiler feed pump the following formulæ is used:

$$\frac{\text{H. P} \times 30 \times 28}{\text{Speed in inches} \times 60} = \text{Area of single cylinder.}$$

This is for a single cylinder piston pump. Of course for a duplex it would be one half this and for a triplex so much.

In very large steam plants the compounding of boiler feed pumps is possibly a move in the right direction, resulting in a considerably more economical consumption of steam. It is very probable that a compound steam boiler feed pump will shortly be introduced which will not be very much more expensive than the ordinary high pressure machine and would certainly be well worth the difference in cost. We have machines of this class operating to-day, with very good results. These compound pumps are made of either the single or duplex type; some engineers preferring the duplex machine and others favoring the single. So far as economy is concerned, possibly the single pump is most economical, as there are less clearance spaces to be filled and consequently a more economical use of steam.

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* Paper read by C. E. Morgan, of the Northey Mfg. Co., before Toronto No. 1 Canadian Association of Stationary Engineers.

Another feature which the single pump possesses over the duplex is that in its length of stroke it is uniform, while the duplex pump invariably short strokes on either side, which further increases waste in the use of steam. The duplex pump, however, is perfectly positive in its steam end, while the single pump has been known to give some trouble in this respect. But this is usually due to the inferior construction of the automatic valve gear. There is no good reason why a steam thrown piston valve should not be equally as positive in its operation as the positively moved one if the ports, both steam and exhaust, are properly proportioned and made strictly to templates.

I think the field of boiler feed pumps has been pretty well covered, and I will, for a few minutes, take up the condenser question.

The question of economy is being studied more closely to-day than was the case some few years ago, and manufacturers are asking for the most economical steam plant that can be installed. In order to achieve these results, condensing engines of different styles are being called for, and independent condensers of many types are being made to-day—the horizontal single and duplex form, and the vertical single and double acting duplex or twin type, or the rotative type. The choice of any one of these condensers is regulated by the size of the plant, and for ordinary small plants possibly the horizontal single type of condenser is the cheapest. When large units, however, have to be considered the most efficient and economical type of air pump and condenser should be installed.

Undoubtedly the most efficient type of air pump to-day is the single acting vertical, its high efficiency being due to the fact that all clearance spaces can be practically dispensed with, and being of the single acting type, the velocity of flow is not checked by diversion. Being provided with foot and bucket valves, and these valves always covered with water, there is very little clearance space.

The lack of efficiency in the double acting horizontal or vertical type of pump is largely due to the reverse of some of the above conditions, as, by the failure of the valves in closing and also a large space between the suction and delivery valves. The speed at which air pumps can be operated depends upon the valve area which they contain. This, in a great many cases, is very much contracted, and accounts for the unpleasant noise which air pumps are sometimes known to make on board steamers. If this valve area could be increased the pump would work somewhat quieter.

Beyond doubt the most economical style of air pump is the rotative vertical type, as it enables you to use steam expansively. Its first cost, however, is very much greater than the direct acting vertical type, and on account of its rotative action it is considerably more expensive to maintain. I think it is possible to construct an air pump of a design which will allow of the valve area being very largely increased and consequently a higher speed made practicable. This experiment is at present under test, and we have every reason to believe it will prove of great commercial value.

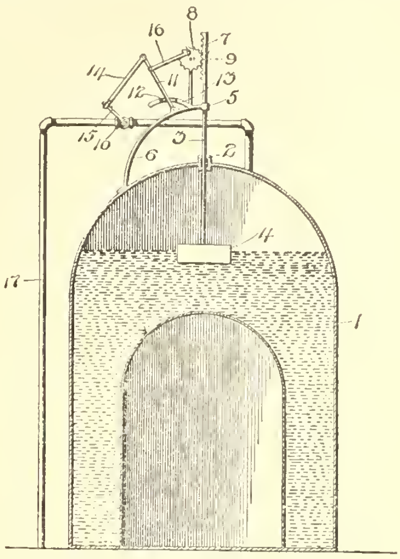
For the practical engineer, perhaps a rule which is used for the proportioning of an independent air pump and condenser for certain sized engines would be well to remember. The data which is required before being able to estimate, is the class of engine which is being used, the pressure of steam supplied the engine, point of cut-off, and the number of revolutions, or piston feet travel, per minute. By referring to our list on page 69 of our catalogue, you will find the maximum steam that certain sized air pumps are capable of condensing per hour. This, of course, is based on an assumption that the injection water is supplied at a temperature of from 60 to 70 degrees.

I have not thought it well to occupy your time with any other class of pumping machinery but what we are familiar with, and may say that the pumps which are used for mining, pumps that are used in pulp and paper mills, and the triplex power pump, and special pumps for special purposes, have not been touched upon in this paper.

We shall, however, at a future date, be glad to take up this matter and refer to some of the uses which pumps are put to in the many manufacturing industries throughout the country.

WATER FEED REGULATOR FOR BOILERS.

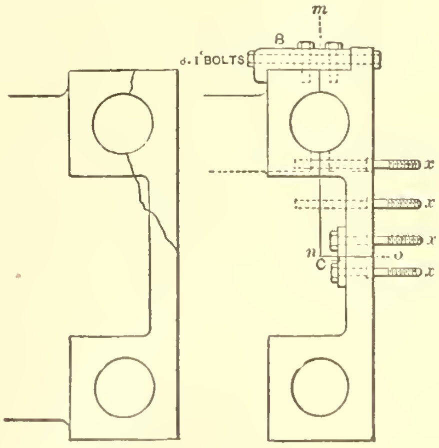
Mr. W. H. Tobey, of Tupperville, Ont., has been granted a patent in Canada for a water feed regulator for boilers, as shown in the accompanying illustration, for which he makes the following claim: The combination with a boiler, having a water inlet supply pipe and a valve located in said supply pipe to regulate the passage of water into said boiler, of a float mounted to have a vertical movement within said boiler, a pinion mounted to have an operative connection with said float, whereby a vertical movement of said float will impart a rotary movement to said pinion, and connections operatively connected to said pinion and the handle of said valve, whereby the movement of said pinion will serve to impart an oscillatory movement to said handle, substantially as described.



Water Feed Regulator for Boilers.

REPAIRING AN ENGINE.

An interesting repair job undertaken at the Corliss shops at Providence is shown in the accompanying illustration from Power. An engine, probably from an overdose of water, had knocked out the cylinder head, carrying with it a portion of the flange and of the steam valve bonnet as shown in the left-hand sketch. The broken metal was planed away along the central lines (mn no) of the valves and cylinder bores and a casting made to replace the missing section now regular in shape. Fourteen collar studs were put in the end as shown (x), four of which passed through the port. The joint was made of copper. After the patch was in place the cap (B) was put on and the valve chamber rebored. Links were shrunk on C to make the joint on the plane (n o). The engine is now running regularly and giving no trouble.



Repairing an Engine.

The Toronto offices of The Royal Electric Company have been removed from No. 36 and 38 York street to No. 76 King street west. This move was rendered necessary owing to the buildings occupied on York street being sold to the W. L. Johnson Company, who purpose erecting a large building on the site for the manufacture of clothing. The new offices of the Royal Electric Company at 76 King street west are commodious and a decided improvement over the old location.

ELECTRIC RAILWAY DEPARTMENT.

STREET CAR CONTROLLING DEVICE.

Mr. Duncan McDonald, superintendent of the Montreal Steeet Railway, has invented a device by which he hopes to prevent the too sudden starting of street cars. On the top of the controller is a series of eight stops placed at stated intervals and in a circle. Attached to the handle is a spring arrangement which connects with these stops. The handle runs around freely until the first stop is encountered. Then in order to put on more power a pressure on the handle is necessary. A pressure on the handle top allows the power to be applied to the next stop, and so on until the entire circle has been negotiated. In order to go from a stand-still to full power ahead a lapse of from eight to ten seconds is necessary. By the old method one sweep of the handle would do it all. Of course there is nothing to interfere with the rapid turning off of the power; this can be done with one sweep of the handle as formerly. Mr. McDonald explains that no matter how carefully a motorman was trained, there were times when he would send on the power more quickly than he should. Perhaps it might be his anxiety to make up lost time and get up with his schedule, or a dozen other complications; the result was the same.

MANHATTAN ELEVATED ELECTRICAL EQUIPMENT.

The Manhattan Railway Co., of New York, last month awarded to the Westinghouse Electric Co., of Pittsburg, Pa., one of the largest contracts for electrical equipment that has ever been placed, it being in connection with the conversion of their system to electricity. It includes the heavy generating machinery for the new power house and apparatus for sub-stations, which, with the contracts already given for engines, boilers, etc., practically completes the apparatus required for the stationary installation of the electrical equipment of the system. The contract is understood to represent a consideration of about $1,500,000, and, in capacity, about 163,000 horse power. There will be eight three-phase alternating current generators of 5,000 k.w. each, seventy-eight 550 k.w. step-down transformers, and twenty-six 1,500 k.w. rotary converters. The generators will be the largest ever designed or constructed, their external dimensions being something over 40 feet, while the rotating element, which includes in itself the rotating field of the generator and the necessary fly-wheel for the engine, has a diameter of 32 feet. The weight of each machine and engine complete will be nearly 1,000 tons. The generators will have stationary armature and revolving fields. The armature winding will be of the bar type, using three bars per slot and four slots per phase per pole. The installation of the armature conductors is guaranteed by the manufacturers to withstand a puncture test of 25,000 volts alternating applied between copper and iron for thirty minutes.

The rotary converters will have 18 poles, and will, therefore, make a little less than 170 r.p.m. Their fields will be compound wound, to provide a certain amount of automatic regulation of the direct current potential, which will range from 575 to 625 volts. The step-down transformers will be cooled by air. They will be connected in groups of three to each rotary converter.

The Westinghouse Company are to be congratulated upon this order, as it is understood that the Manhattan Railway Co. have been actively studying the problem for over two years with a view of securing an equipment of the highest efficiency and of the most modern construction. Messrs. Ahearn & Soper, of Ottawa, are Canadian agents for the Westinghouse Company.

SPARKS.

The Mount Royal Park Incline Railway Co., of Montreal, have appointed a committee, consisting of Messrs. Mann, Vallance and Turner, to report on the conversion of the power plant from steam to electricity. Last year this road carried 325,000 passengers.

The promoters of the proposed electric street railway at Sarnia, Ont., are rapidly completing the preliminary arrangements. According to the franchise granted by the council, the company agree to have a portion of the road in operation by July 1st, 1900, and the balance within twelve months from that date.

It is understood that Mr. Clyde K. Green, manager of the Hamilton Radial Railway, has been appointed traffic manager of the Cataract Power Company's electric railways, and that Mr. J. B. Griffith, late manager of the Hamilton Street Railway, is to be chief of the purchasing department of the consolidated lines.

Mr. J. S. Campbell, of St. Catharines, has made application for the incorporation of the Niagara and South-Western Electric Railway Company, with power to construct an electric railway from Niagara-on-the-Lake, through St. Catharines and Smithville, to Hagersville, with branches to Dunnville, Cayuga and Queenston.

The Berlin & Waterloo Electric Street Railway Company have given a contract to the Volta Electric Storage Company, of Hamilton, for 16 storage batteries. These will be used to supplement the power furnished by the generators and to overcome the difficulties frequently experienced by heavy loads. The system is now being installed.

The application of the Demerara Electric Company for a franchise to construct electric railways in the city of Georgetown, Demerara, has been granted on terms satisfactory to the company. The capital stock of the company is $850,000, and the directors include Sir Wm. Van Horne, Senator Drummond and W. B. Chapman, of Montreal, and B. F. Pearson, of Halifax.

Mr. Chas. Cadmus, representing Hamilton and Toronto capitalists, is endeavoring to organize the Huntsville and Lake of Bays Railway Company, for the purpose of constructing a steam or electric railway over the pertage between the Lake of Bays and Peninsula Lake, in Muskoka district. The cost is estimated at $20,000, but as it is proposed to engage in mining also, the capital has been placed at $100,000.

At a meeting held in New York city a fortnight ago, all the street railway interests in the city of Havana, Cuba, were consolidated. Under the terms of the arrangement the Havana Electric Railway Company acquires the rights and stock of the Havana Traction Company. It is now expected that a complete system of electric traction will be in operation by the first of June next. Sir William Van Horne and William Mackenzie are interested in this enterprise.

By a new time table inaugarated by the Toronto Railway Company, an increase of 4,000 miles per day run by the cars was effected. On the day on which the figures were taken, 232 cars were in use, which ran 25,520 miles and carried 115,701 passengers, whose fares amounted to $4,026.67. On the same date last year there were 210 cars in use, which ran 21,547 miles, and carried 82,292 passengers, whose fares amounted to $3,548.60, showing an increase of 3,673 miles traveled, 22,400 passengers, and $087.07 in receipts. Thus the Toronto street cars every day run a distance equal to the circumference of the globe, and carry more than half of the whole population of the city.

SPARKS.

The Herald Publishing Company, of Montreal, have ordered a 30 h.p. 250-volt motor from the Canadian General Electric Co.

An engineer is wanted to take charge of the steam heating and electric lighting plant in St. Francis Xavier college at Antigonish, N.S.

The growth of the demand for electric light at Beeton, Ont. has been so rapid that additional machinery will shortly be required.

After sustaining the struggle for seven months, the Trades and Labor Council has given up the strike against the London Street Railway Company.

The Merchants Cotton Company, of Montreal, are installing a 60 k.w. generator of Canadian General make, directly connected to 13″ x 12″ Ideal engine.

The power house of the Exeter Electric Light Company, at Exeter, Ont., was totally destroyed by fire on December 10th, together with all machinery.

The Toronto Carpet Mfg. Company have increased their original order to the Canadian General Electric Co., and are now putting in a 55 k.w. generator.

The Drayton Electric Light Company, of Drayton, Ont., are revamping their station equipment, and have placed an order for a 30 k.w. S.K.C. two phase machine with the Royal Electric Co., of Montreal.

The Manhattan General Construction Company, of Newark, N.J., have sold through their Toronto office a thirty-five lamp alternating current series arc lighting plant, including regulator, to the corporation of Campbellford, Ont.

The corporation of Bothwell, Ont., are increasing their plant by the installation of two 20 k.w. generators to replace those originally purchased. The order, as in the first case, has been placed with the Canadian General Electric Company.

The St. Thomas Gas & Electric Company are increasing their lighting capacity, and in doing so have decided to change their lighting system from single phase to two phase, having ordered from the Royal Electric Company a 50 k.w. S.K.C. two-phase machine, with marble switchboard and instruments.

The corporation of Picton, Ont., have awarded their meter and supply orders to the Canadian General Electric Company.

Mr. A. Gagnon proposes to connect Victoriaville and Arthabaskaville by an electric railway, provided the ratepayers of these places grant the necessary bonus.

The St. Francis Xavier College, Antigonish, N. S., have placed an order with the Canadian General Electric Company for a storage battery plant, to consist of fifty-five cells, and one multipolar 4-17½ k.w. direct current generator.

The Kingsville Electric Light Company, Kingsville, Ont., are increasing the capacity of their incandescent plant by the addition of a 75 k.w. alternator, the order for which has been placed with the Royal Electric Company.

Mr. Joseph V. Ward has recently constructed for Doctors Law and Dunn, of Beeton, Ont., a telephone line connecting Beeton with the villages of Newton Robinson and Pennville. There are three telephones on the line. The telephones are free to the doctors' patients, a charge being made to other users. On arrival at Beeton messages are transferred to the local system of the Bell Telephone Company. The extension of the private lines six miles in the opposite direction is under consideration.

The Orangeville Electric Light & Power Company are improving and extending their plant to meet a constantly increasing business and a demand for an improved and economical street lighting circuit. For their incandescent requirement they have ordered another standard 60 k.w. alternator, with a complete new panel board for both machines. For the street lighting the present open arc direct current plant will be abandoned, and in place will be installed a constant current alternating system. This will consist of a 50-light series transformer, with switchboard for same, together with 30 improved constant current lamps for operation from the same. This company has recently discarded the old 52-volt individual transformer system, substituting therefor large size type "H" transformers, feeding into a complete system of 3-wire secondary mains designed in accordance with modern practice. The single phase system will be adhered to as being the simplest and most flexible for lighting purposes, as demonstrated by its past satisfactory operation. The Canadian General Electric Company have the entire contract.

JOHN R. BARBER, President. *GEO. E. CHALLES, Sec.-Treas.*

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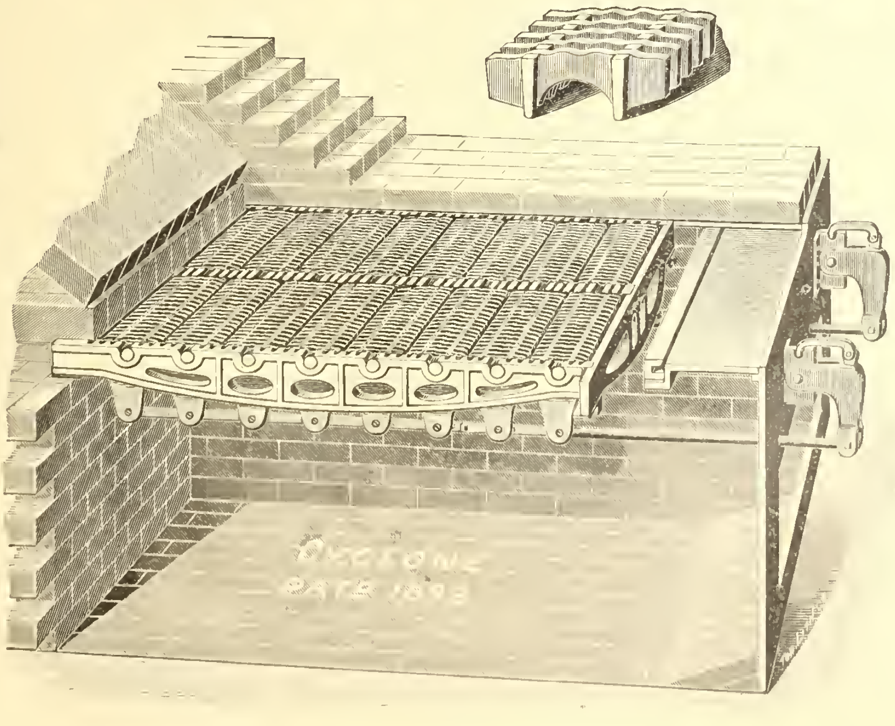

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CANADA PACIFIC RAILWAY COMPANY,

MR. H. TRUESDELL, 146 Spadina Avenue, Toronto.

Winnipeg, Manitoba, W., May 25th, [illegible].

DEAR SIR,— I herewith send you the result of the test between your Grate and the ——— Grate, which was made here on the 18th and 19th insts. You will be glad to know that the **CYCLONE GRATE** showed up more favorably than the ——— Grate, and the report of the Inspector is also favorable, showing that it is a more easily managed Grate and a Grate that is not liable to get out of order.

Yours truly,

(Sgd.) W. CROSS, General Master Mechanic

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THE CONMEE ACT.

In the article headed "A Warning," printed in our December issue, referring to certain provisions of the Conmee Bill designed to protect the interests of lighting companies, the sub-section to which the article was intended to refer was inadvertently replaced by a sub-section which had no bearing on the point under consideration. The error was not discovered until after the article was printed. Under these circumstances we deem it advisable to print herewith the sub-section of the Act to which our previous article was intended to refer, and which is as follows :

(a) In case there is any gas, electric light or water company incorporated for or in the municipality, the council shall not levy any such special rate, or construct works for lighting the public streets, until such council has, by by-law, fixed a price to offer for the works and property of the company or companies, nor until after thirty days have elapsed after notice of such price has been communicated to the company or companies without the company or companies having accepted the same, or without the company or companies having, under the provisions of this Act, as to arbitrations, named and given notice of an arbitrator to determine the price, nor until the price accepted or awarded has been paid, or has been secured to the satisfaction of the company or companies, and in case the company or companies and the municipality do not agree, the said price shall be determined by arbitration under this Act ; and where there is more than one such company in the municipality, the arbitrators shall determine the share or proportion of the price to be paid to each company. This clause (a) shall only apply to a gas or electric light company that has supplied or shall supply gas or electric light for street lighting in the municipality, or to a water company that has supplied or shall supply water for street hydrants in the municipality.

SPARKS.

By a majority of over 700 votes the ratepayers of Ottawa have decided in favor of civic control of electric lighting.

Sir Wm. Van Horne and Mr. H. S. Holt, the latter president of the Montreal Gas Company, have been elected to the directorate of the Canadian General Electric Company.

At the municipal elections the ratepayers of Prescott, Ont., voted in favor of handing over the management of the electric light plant now operated by the town to the water commssioners.

When all the improvements now under way are completed, the electrical plant in the Montreal Cotton Company's mills at Valleyfield, Que., will be the largest in capacity of any plant similarly employed on this continent.

Mr. Roderick J. Parke, E.E., of Toronto, has been engaged as consulting engineer by the Arnprior Electric Light & Power Company, to advise on the reconstruction of their plant, considerable additions to which are contemplated.

A company has been formed at Windsor Mills, Que., to install an electric light plant for lighting the streets, stores and residences. The council has granted a franchise to the company, and it is understood that work will be commenced early in the spring.

The city council of Ottawa has passed a by-law extending the franchise of the Metropolitan Electric Company to twenty-one years. The Deschenes Electric Company have also made an application to the city for a franchise to supply electricity.

The St. Thomas Gas & Electric Company are making extensive changes in and additions to their plant to meet increasing demands. For arc lighting purposes they are installing a Brush arc dynamo with capacity for 125 lamps, manufactured by the Canadian General Electric Company. This company has also been operating the St. Thomas street railway for some time past from their power house, using two 100 k.w. generators of the General Electric standard type.

The War Eagle Consolidated Mining Company is said to have issued a writ against the James Cooper Manufacturing Company, of Montreal, and associated companies, claiming damages on account of certain machinery supplied working unsatisfactorily.

The New York Journal of Commerce states that the American Air Power Company, of New York, are likely to establish a branch of their works in Canada. They make a specialty of manufacturing apparatus for the propulsion of street cars by compressed air.

The Electrical Maintainence & Construction Company, of Toronto, report that in addition to a number of contracts for house wiring and extensions throughout the city, they are installing 600 lights at the Government House, 250 lights for the Macdonald Mfg. Co., 100 lights for the General Hospital in Toronto, and 1,000 lights for the Canadian Colored Cotton Co., Hamilton.

The electric light by-law of the city of Greenwood, B.C., having finally passed, Messrs. George C. Hinton & Co., of Victoria and Vancouver, have added the contract for the equipment of this Kootenay town to the many others they have completed, or are attending to in that part of the world—for many of the Kootenay towns have been provided with electric light and power by this same hustling firm. The present contract is for one 150 k. w. 2;000 volt two phase S.K.C. inductor type generator of 3,000 light capacity, complete with all equipments, material, insulators and supplies. The generator, switchboard, etc., will be of the very latest and most approved pattern. The entire plant will cost in the neighborhood of $20,000, and will be fully installed during the ensuing ninety days.

The attention of our readers is directed to the announcement in this issue of the American School of Correspondence, offering thorough technical training by mail. This institution claims to be the only correspondence school in the country making a specialty of steam, electrical and mechanical engineering. A careful inspection of the school's attractive instruction papers convinces one of the painstaking thoroughness and accuracy which distinguishes the work of this New England institution. The school is chartered by the commonwealth of Massachusetts and enjoys the respect and confidence of thousands of earnest students throughout the United States. The instructors are all graduates of leading scientific schools, and have had valuable experience along engineering lines. The benefit to the student of this expert supervision cannot be over-estimated. The courses have been carefully laid out by prominent educators and engineering experts. They embrace every subject required by the up-to-date engineer and mechanic in order to have complete mastery over the theoretical details of his daily work. The school was founded to give high grade instruction to those men who have been compelled by adverse circumstances to leave school at an early age in order to make a living. With this idea in view, the tuition has been purposely placed very low, so that no wage earner shall be debarred from receiving the benefit of such a course. By taking advantage of this school's generous offer, the ambitious mechanic can receive a thorough technical education in his profession by merely devoting his spare moments to systematic home study. Almost every man has, at some time, felt the need of a better knowledge of the theoretical details connected with his work, and this school has been founded to supply this much needed education. The school will be glad to furnish a catalogue on request, describing its methods, and letters from graduates giving results of their experience.

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TRADE NOTES.

Mr. H. Corby, Belleville, Ont., has placed an order with the Royal Electric Co. for a 100 light direct current generator.

The Clappison Pipe & Boiler Covering Co., of Hamilton, have been awarded the contract for pipes and boiler covering for the Longue Pointe Asylum, near Montreal.

Messrs. Gilmour & Co., of Trenton, Ont., have lately installed in their mills a 100 light direct current generator from the Royal Electric Co.

The Granby Consolidated Mining & Smelting Co., Grand Forks, B.C., have installed a 50 light direct current generator of the Royal Electric Co.'s manufacture.

The Toronto Electric Light Co. have equipped their new Heine boilers with Jubilee shaking grate bars, manufactured by the Jubilee Grate Bar Company, of Toronto.

The Merchants' Cotton Co. has placed an order for all the belting in its new extension, to contain 500 looms and 20,000 spindles, with D. K. McLaren, Montreal. The order includes 155 feet 50 inch, 3 ply; 160 feet 14 inch, 3 ply; 500 feet 10 inch, 2 ply; 800 feet 6 inch, 2 ply.

The Grant-Hamilton Oil Co., of Toronto, Limited, has been granted a charter, with a capital of $40,000. The company will do a general business in oils and engineers' supplies. The provisional directors are G. W. Grant, T. H. Hamilton, John M. White, Andrew Dods and Wm. Irwin.

The Toronto Rubber Shoe Manufacturing Co., who have recently been awarded the contract to supply electric light and power to the town of Port Dalhousie, have retained the services of Mr. R. J. Parke, E.E., of Toronto, to provide plans and specifications for the necessary plant, which will include a 150 polyphase generator and approximately 100 h.p. in motors. This plant will also provide light for the company's factory, for which about 800 incandescent lights are required.

The iron flume built by Mr. G. K. Nesbitt, owner of the electric light plant at Cowansville, Que., burst on December 20th, depriving the inhabitants of electric light for a few days.

The Montreal Street Railway Company will likely put into use a new invention for removing a heavy fall of snow from the tracks. The device has been invented by Mr. Wm. Pont, foreman of the Hochelaga car sheds, and consists of a large wing, 12 feet long, attached to one side of the sweeper near the rear. After the brushes on front of the sweeper throw the snow up off the track, the wing comes along and throws it back to near the sidewalk, so that it is not again thrown on the tracks by sleighs in crossing.

The ratepeyers of Bedford, Que., have petitioned the council to have the streets lighted by electricity.

Pratt, Patching & Company, of Tweed, Ont., have purchased a new engine for their electric light plant.

The death is announced of Mr. Frank Gormley, of Montreal, who in early life was employed by the Montreal Telegraph Company.

The electric lighting plant at the Soulanges canal was tested on December 18th, under the direction of Mr. Thos. Monroe, chief engineer. The light was found very satisfactory. The plant was installed by the Canadian General Electric Company.

ELECTRICAL REPAIRS

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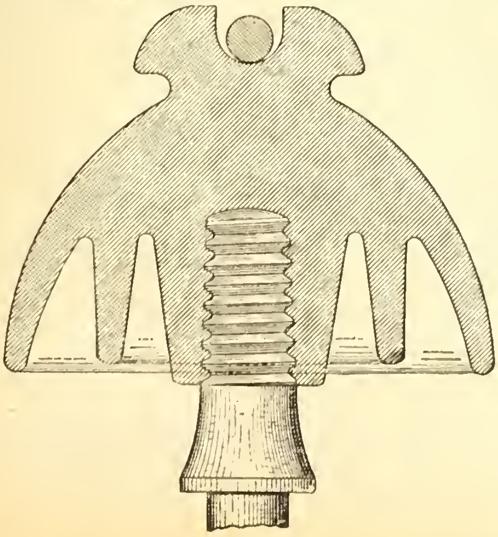

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Address all Correspondence to

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General Agent, 7 ARCH STREET, BOSTON, MASS.

SPARKS.

The Columbia Telephone & Telegraph Company have acquired the lines of the Spokane Falls and British Columbia Telephone Company.

The Dominion Iron & Steel Company, of Sydney, Cape Breton, have added another 40 h.p. 250-volt motor to the order already given for electric plant. The Canadian General Electric Co. have the entire contract.

Mr. C. D. Dyke, inspector for the Bell Telephone Co., while repairing wires at Peterborough last month, slipped from the top of a forty foot pole and fell to the pavement, breaking his left leg and otherwise injuring himself.

Mr. J. M. Deagle, of Cataract, Ont., has placed his order for a complete electric light plant for the town of Erin, with the Royal Electric Company. The order includes a 30 k.w. alternator and 300 light capacity in transformers.

The Ogilvie Milling Co., of Winnipeg, Man., have purchased from the Canadian General Electric Co. a 50 k.w. direct current generator of their standard multipolar slow-speed type, and marble generator and feeder panels.

Within the past year the Ottawa Car Works Company expended nearly $18,000 in buying additional land, building an extension to the car construction room, erecting a boiler house and dry kiln, and installing the latest system of heating and ventilation.

Napoleon Savard, a telegraph lineman, was killed in Montreal by coming in contact with a live wire. He and his brother were replacing and coupling wires at the top of a pole, and while in the act of splicing two ends he grasped the wires with both hands.

The Grand Valley Railway Company will make application at next session of the Dominion parliament for power to construct a steam or electric railway from Goderich through Berlin, Galt, Brantford and Simcoe to Port Dover, with branches to Listowel, Elora and Stratford.

The Westport & Digby Telephone Company's cable in Petit Passage, the channel connecting Long island and Digby neck, was repaired on Dec. 15th by Mr. F. A. Hamilton. This cable was interrupted in November by a vessel dragging her anchor through it during a heavy gale.

The Toronto Rubber Shoe Manufacturing Company have purchased a thirty-five lamp alternating current series arc lighting plant, including regulator, for their factory and the street illumination of Port Dalhousie. The Manhattan General Construction Company, of Newark, N.J., are furnishing the equipment.

The Bell Telephone Company's new directory for Western Ontario shows a marked increase in the use of the telephone. In Stratford there are now over 230 instruments, while London's subscribers number nearly 1,400. There are 221 telephones in Woodstock, 224 in Galt, 282 in Guelph, and 359 in Brantford.

The Pennfield & St. George Telephone Company held their first meeting at Beaver Harbor, N. B., on December 7th, the President, Mr. S. L. Dakin, in the chair. The company, incorporated last October, has constructed lines connecting St. George, Black Harbor, Pennfield and Pennfield Centre. In the spring a line will be built to Lepreaux and Bay Bay.

The Montreal Cotton Company, of Valleyfield, Que., are pushing the extension to their new power house, and expect that by May 1st next it will be complete and the new 1,200 k.w. generator in operation. An interesting feature of this installation, which will be the largest industrial electric plant in the world, is the switchboard arrangement. This will consist of a series of blue Vermont marble panels 36″ wide by 88″ high, upon which will be mounted the necessary switches for controlling the motor circuits, and all instruments for controlling the generators and exciters. There will be used for present equipment 12 feeder panels and 6 generator panels. The entire board, as covered by present orders, will be 54 feet long, and when complete will present an imposing appearance, and will meet all requirements necessitated by the peculiar conditions under which this plant operates. The entire work will no doubt reflect credit upon the Canadian General Electric Co., to whom the contract has been awarded.

PUBLICATIONS.

A Christmas number of the British Columbia Mining Record to hand. Its contents are devoted largely to the early history of British Columbia, in connection with which most interesting illustrations are presented. Sir Charles Hibbert Tupper contributes to the number an able article on "The Alaskan Question".

Catalogue No. 75 has been received from Messrs. Jack & Robertson, of Montreal, sole agents for Canada for the Sprague Electric Co., of New York. This catalogue is devoted to interior conduit. In it special attention is called to the Greenfield flexible metallic conduit, which, owing to its low price and saving of labor in installing, is claimed to have reduced the cost of modern conduit work even more than did the introduction of uninsulated planed iron pipe. The Sprague Company is the pioneer in this department of the electrical field, and all its manufactures are approved by the National Board of Fire Underwriters.

The average Canadian has not been afforded the opportunity of studying the history of South Africa and the causes which have led to the present Boer war. A knowledge of this fact induced Mr. E. B. Biggar, of Toronto, to publish a little booklet entitled "The Boer War, Its Causes and Its Interest to Canadians." So well was the first issue received that three subsequent editions have been published. The author resided in South Africa for five years, and is therefore conversant with the conditions existing in that country. The price is ten cents, and copies may be obtained through the Toronto News Co. or the Montreal News Co.

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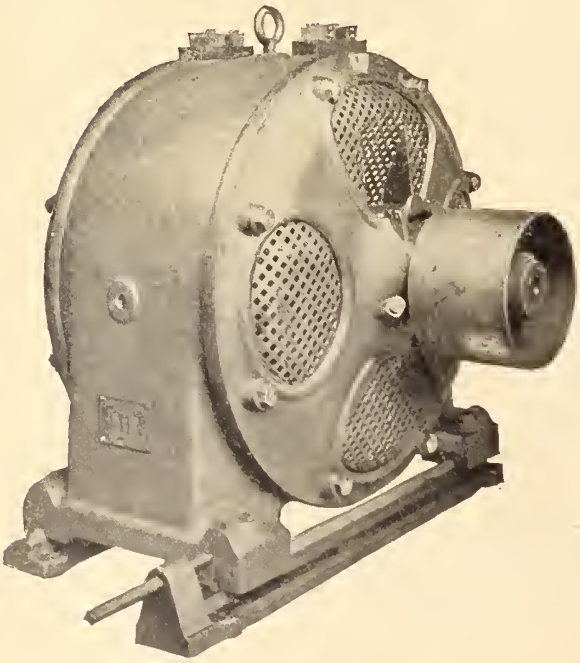

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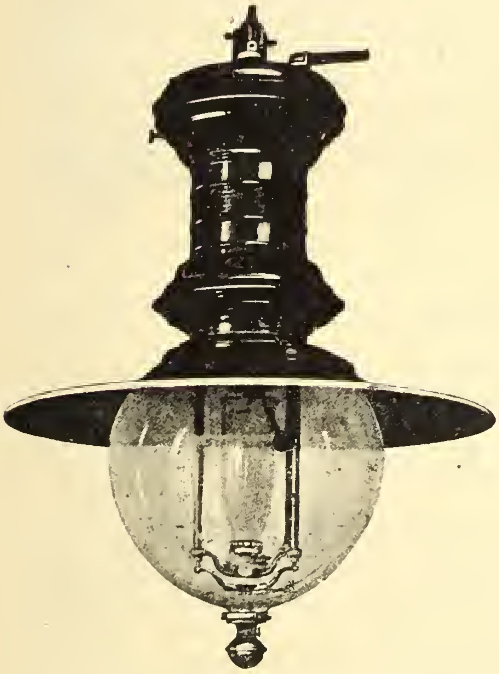

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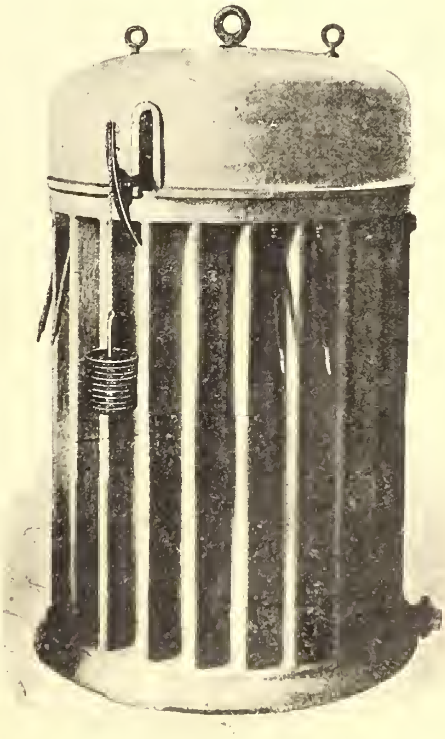

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SPARKS.

The streets of Liverpool, N. S., were lighted by electricity for the first time on December 20th, 1899.

The contract for wiring for electric lighting the Mount Allison residence at Sackville, N.B., has been secured by John Starr, Son & Co., of Halifax.

Mr. L. Smith, of Blenheim, Ont., is said to be considering the putting in of an electric light plant at Little Current, Ont., for street and commercial purposes.

The demand for incandescent lighting has been so great in Newmarket, Ont., that the extension of the plant will be considered by the council at an early meeting.

The Department of Justice, Ottawa, has engaged Mr. R. J. Parke, E.E., of Toronto, to act as consulting engineer in connection with the installation of a 150 k.w. electric lighting and power system for Kingston Penitentiary.

The Coaticook Electric Light & Power Co. are increasing their plant by the installation of another 2,000 light alternator, with switchboard, and a 100 k.w. 500 volt power generator. Both are being supplied by the Canadian General Electric Co.

The Cataract Power Co. are building a brick addition to their transformer station on Victoria avenue, Hamilton. It is understood to be the intention of the company to duplicate their transmission line from the power house near St. Catharines to Hamilton.

A friend of Professor Owens, chief of the electrical department of McGill University, Montreal, has donated the sum of $10,000 to establish a research scholarship in electrical engineering at McGill. The gift is highly appreciated by the university authorities.

A public meeting of the ratepayers of Yarmouth, N.S., will be held on the 15th inst. to consider the question of raising $13,000 for enlarging the pumping station and installing the necessary pumps, steam engines, boilers and other appliances for operating the waterworks system.

The American Alkali Co., of Sault Ste. Marie, have ordered the switchboard panels, with instruments, for their new works from the Canadian General Electric Co. We understand that the 3 150 k.w. electrolytic generators which this company is building also will soon be started.

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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N. Y. Evening Post, Oct. 9 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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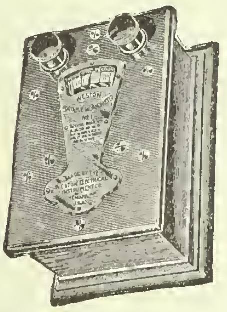
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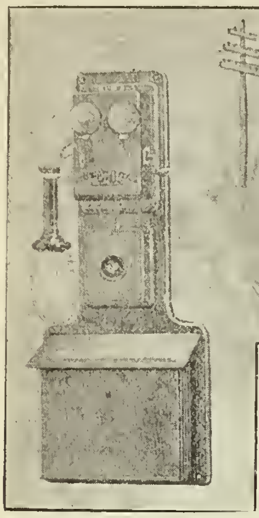

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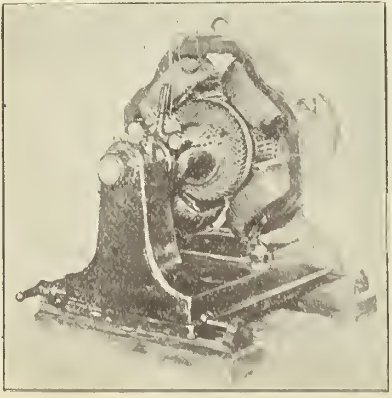

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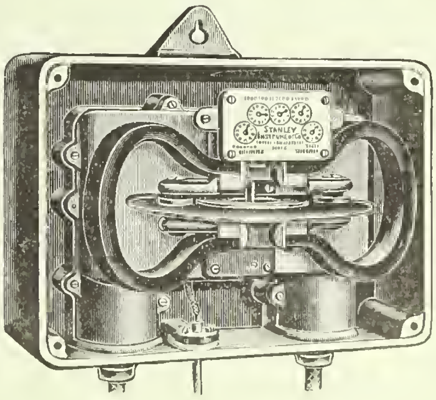

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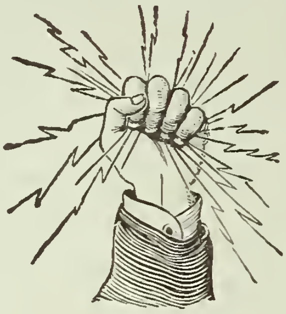

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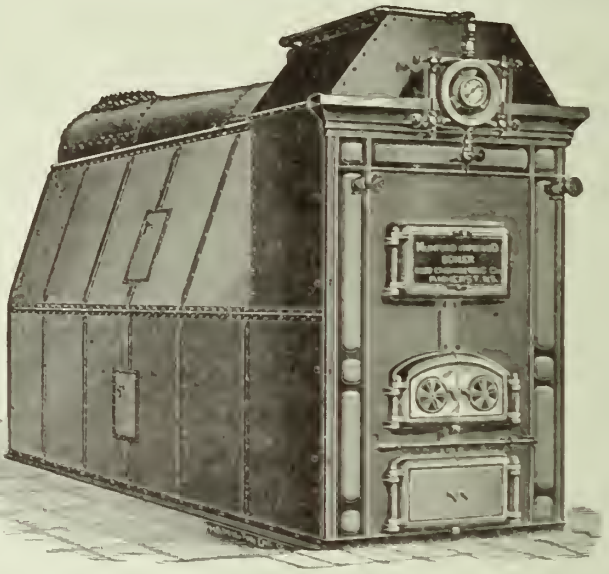

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is built with Sheet Steel Case or for Brick Casing, as desired. It has an Internal Firebox, Water Circulation similar to a Water Tube Boiler, large heating surface, and special arrangements for preventing and removing scale.

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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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THE AUTOMOBILE MAGAZINE

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$3.00 A YEAR.

N. Y. Evening Post, Oct. 9, 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comical uses of pencil and verse. The magazine seems free from bias.

The M'Cormick Will develop more power from a given quantity of water than any other Turbine.

OUR WHEEL GIVES MORE THAN DOUBLE THE POWER OF MOST WHEELS OF THE SAME DIAMETER, BY REASON OF WHICH THE COST IS LESS PER HORSE POWER.

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The preparatory chapters are devoted to a concise explanation of the foundation principles of mathematics, a knowledge of which is absolutely essential to the study of Electricity and Engineering. In the succeeding chapters the student is led by gradual stages to a more complete acquaintance with these subjects and is equipped with knowledge sufficient to enable him to pursue his researches to any further extent.

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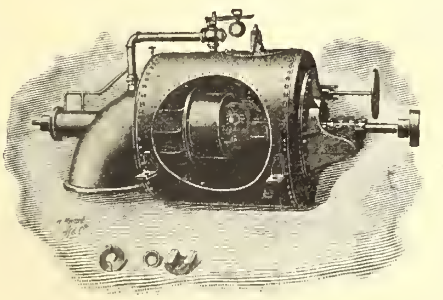

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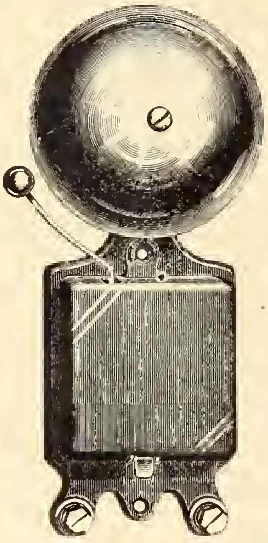

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A PREMIUM OF $0.50 for every Lamp installed on

THE FLAT RATE SYSTEM

PAID AT OUR OFFICE to Contractors on presentation of our lighting contract duly signed and the work passed by our Inspector.

(See Clause 5 and foot note in Rules Governing Wiremen Below) . . . .

RULES GOVERNING WIREMEN

NOTE.—It is the intention of this Company to give the best light possible, and if the rules which are tabulated below appear to be rigid, it is not because the Company desires to act with any unnecessary severity towards any contractor, if its inspector enforces these rules, but simply because the Company wants to see its customers get satisfaction which they would not do unless the wiring is of the highest order.

(1)—The Company reserves the right to refuse to accept any new installation unless the work has been done strictly in accordance with the existing rules of the Fire Underwriters' Association for this class of work.

(2)—The Company reserves the right to refuse to make connection to an installation where the voltage drop is greater than one volt at any lamp when the maximum number of lamps are burning.

(3.)—This Company will furnish the first installation of lamps in all cases and in the case of Meter Rate consumers, burnt out lamps will be exchanged for new ones at the Company's office. If the lamps are purchased elsewhere they must yield an efficiency of not less than one Candle Power for each 3.1 watts energy expended, and they must be of a make which is satisfactory to the Company.

(4)—No charge will be made for service connections and no meter rent will be charged.

(5)—For each lamp on all new installations connected to this Company's service mains, the following premiums will be paid to the contractor having brought the signed contract to the Company's office and having done the work :—

FLAT RATE SYSTEM.—50 cts. for each lamp installed.

METER RATE SYSTEM.—10 cts. for each lamp of 16 C. P. or its equivalent installed. Such payments to be made to the contractor when the proper application, duly filled out and signed, has been presented, and the Company's inspector is satisfied that the installation has been done in accordance with the above rules.

(6)—An opal or equally good reflector or shade shall be furnished for each lamp on all new installations.

(7)—No connection will be made for less than two lamps, and no meter will be furnished for less than ten lamps.

NOTE.—"All New Installations" in Clause No. 5, means only for places which were not already wired. No commission will be paid for extra lights, or lights changed over to this Company from other existing companies.

Pending the Completion or Inspection of Installations a receipt will be given for all signed contracts brought to the Company's Office, on presentation of which, and if the work has been accepted, the Commission will be paid to the bearer.

Jacques Cartier Water Power Company

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SPRAGUE ELECTRIC CO.
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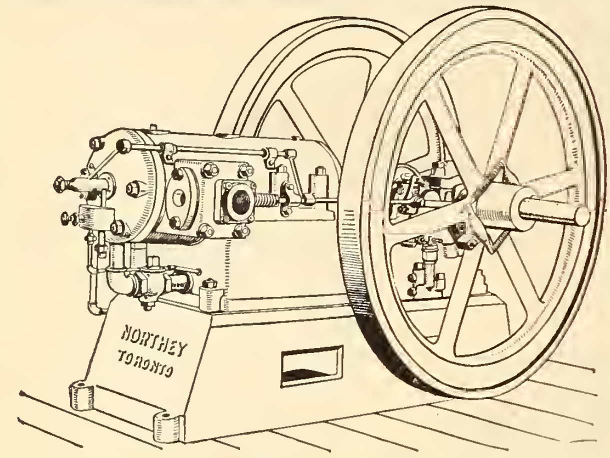

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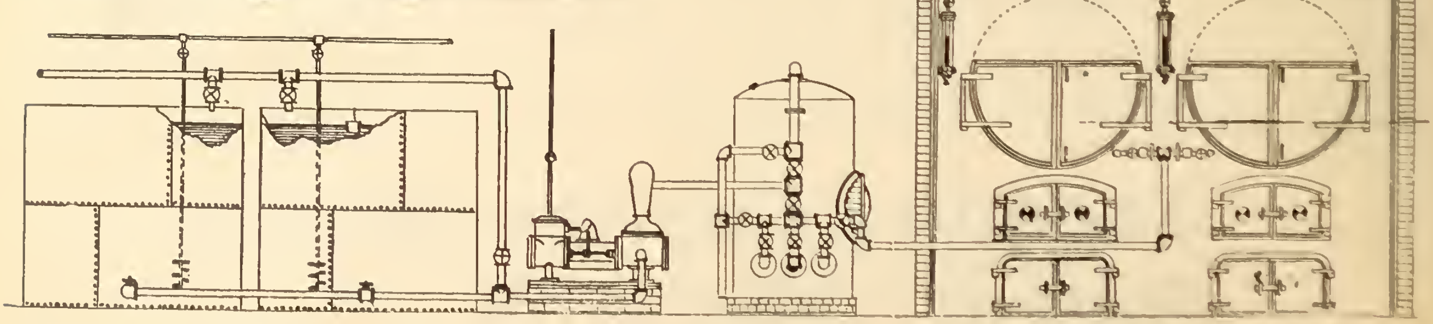


JOHN McDOUGALL - Caledonian Iron Works, MONTREAL, QUE.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. X. FEBRUARY, 1900 NO. 2.

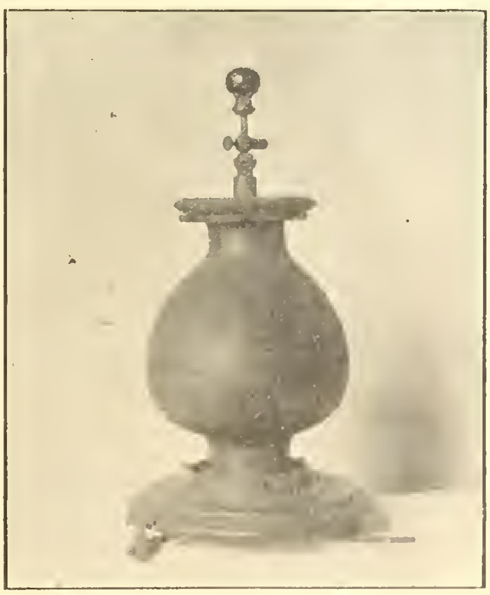
The Incandescent Electric Light

DATA SHOWING ITS ORIGINAL DISCOVERY IN TORONTO, CANADA.—DR. WOODWARD'S PATENT ANTE-DATES THE PATENT OF MR. T. A. EDISON, AND IS PURCHASED BY THE AMERICAN INVENTOR.

Some interesting historical data has recently been placed at our disposal and is herewith presented to readers of THE ELECTRICAL NEWS, relative to the original discovery of the principle of the electric light. It will interest our readers to learn that this discovery appears to have been made in Toronto, Canada, and patented in Canada and the United States prior to the time when a patent was granted to Mr. T. A. Edison. It is quite as interesting to know that the patent for the Canadian discovery was purchased by Mr. Edison in New York City at the time when he was making his original investigations and before he obtained his patent.

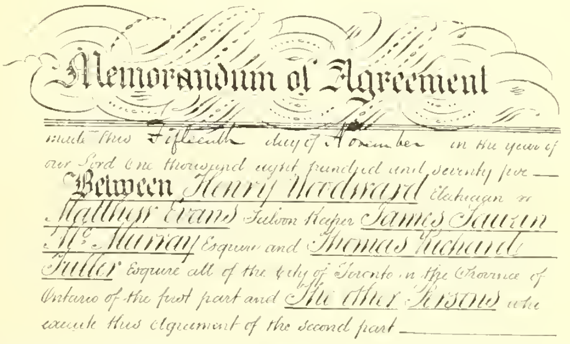
To Henry Woodward, a medical student, and Matthew Evans, a hotel keeper, of Toronto, Ont., appears to be due the credit for the first discovery of the principle of the incandescent electric light. They were neighbors and frequently experimented together with a large Smead battery and induction coil, of which Woodward was the possessor.

While seated at dusk one evening watching the buzzer of the induction coil, the light of the spark at the contact post drew their attention. Evans was the first to notice it, and drawing out his watch exclaimed, "Look at the light from that spark! Why you can see the time!" "My!" said Woodward, "if one could only confine that in a globe of some sort, what an invention we would have! It would revolutionize the world!"



DR. WOODWARD'S PIONEER ARC LAMP.

From this beginning, in the early part of 1873, Woodward and Evans worked to perfect the idea, and on August 3rd, 1874, were granted a Canadian patent. The method of exploiting the discovery is set forth in the accompanying agreement by the original promoters:



Memorandum of Agreement

made this Fifteenth day of November in the year of our Lord One thousand eight hundred and seventy five — Between Henry Woodward Electrician Matthew Evans Saloon Keeper James Saurin McMurray Esquire and Thomas Richard Fuller Esquire all of the City of Toronto in the Province of Ontario of the first part and The other Persons who execute this Agreement of the second part

"Whereas the said Henry Woodward having invented a new and improved method of obtaining light by means of electricity, and having received advances and other assistance from the said other parties hereto of the first part, agreed to grant, convey, transfer and assign to each of them a one-fourth share of interest in the said invention and in letters patent therefor whenever and wherever obtained.

"And whereas the said parties of the first part being desirous of raising a further sum of one thousand dollars for the purpose of obtaining letters patent from Washington and of making certain experiments, agreed to and did by the instrument herein recited grant, transfer, convey and assign seven thirty-fifth parts or shares in the said invention and in letters patent therefor whenever and wherever obtained to the following parties to wit: Rupert Mearse Wells, W. J. Gibson, George Trimble, E. Heimrod, Messieurs McMurray and Fuller, Emma Pepler and M. Sheppard, all of the said city of Toronto, J. E. O'Reilly of the city of Hamilton, and A. M. Sutherland of the town of Barrie.

"And whereas the said instrument is in the words and figures following, that is to say ....

"Whereas Dr. Woodward has invented a new and improved method of obtaining light by electricity, and has obtained letters patent for the said Dominion of Canada, and has made application for letters patent to the patent office at Washington.

"And whereas Matthew Evans, James Saurin McMurray, and Thomas Richard Fuller have each made advances to the said Dr. Woodward for the purpose of assisting him in carrying out the said invention, and are each equally interested with him therein.

"And whereas it is deemed necessary for the purpose of procuring the said letters patent from Washington, and for the purpose of making certain practical experiments with and trials of the said invention, to procure a further advance of one thousand dollars.

"And whereas the said Woodward, Evans, McMurray and Fuller have agreed to divide and apportion their interests in the said invention into thirty-fifth parts, so that each of the last named parties shall hold seven thirty-fifth parts or shares, and that the parties making the said new advance of $1,000, shall also hold seven thirty-fifth parts or shares therein, each new subscriber or contributor to have an interest in the seven thirty-fifths of the invention pro rata according to the amount of his subscription or contribution.

"And whereas the parties hereto hereby agree to the arrangement above mentioned.

"The said Henry Woodward, Matthew Evans, James Saurin McMurray and Thomas Richard Fuller, all of the city of Toronto, in consideration of the said new subscriptions to be obtained and of five shillings to each of them in hand paid, hereby convey, transfer and assign to the other parties hereto a seven thirty-fifth interest in the said patent or invention pro rata amongst themselves according to the respective subscriptions or contributions, and the said other parties hereby agree to pay to the said Woodward, Evans, McMurray and Fuller, for the purposes above mentioned, the amounts set opposite their respective names. And the said Woodward, Evans, McMurray and Fuller agree to use the said money exclusively for the purposes above mentioned in procuring the said letters patent from Washington, and for making the said experiments or trials. It is understood that so soon as the said subscriptions are made, all the parties hereto are part owners in the said patent or invention, and that their interests therein are as above set forth.

THE LATE MATTHEW EVANS.

"It is further understood that the Gramme electrical machine purchased by and imported from Paris by the said McMurray and Fuller, shall, in the event of the ultimate failure of the said invention, be the exclusive property of the said McMurray and Fuller, but in the event of success, it becomes the property of the partnership hereby created on payment of $1300.00.

It is further understood and agreed by and between the parties hereto that Dr. Woodward shall at once proceed to Washington for the purpose of procuring the said letters patent, and that the said experiments and trials shall be proceeded with continuously immediately after his return. And the said Woodward, Evans, McMurray and Fuller promise and agree with the other parties hereto that the said Woodward shall immediately after the said $1,000 shall have been subscribed, proceed to Washington, and shall, if possible, procure the said letters patent, and shall immediately, after his return, proceed continuously for a period of three months with the said experiments or trials, said experiments or trials being made with the view of practically proving that at least fifty electric lights can be shewn from the said machine at the same time.

"And they further agree that the said sum of $1,000 shall be sufficient for the purposes aforesaid.

"Dated at Toronto the fourteenth day of May, one thousand eight hundred and seventy five".

"And whereas the said instument is executed by all parties hereinbefore named

"And whereas the whole of the said one thousand dollars has been properly expended.

"And whereas it being desirable to raise a further sum of money by way of additional subscription for the purpose of taking out letters patent at Washington, the parties hereto of the second part have agreed, in consideration of receiving a further interest in the said invention and in the letters patent therefor whenever and whereever issued, each to advance to the parties hereto of the first part a further sum of thirty-three ($\frac{33}{100}$) dollars.

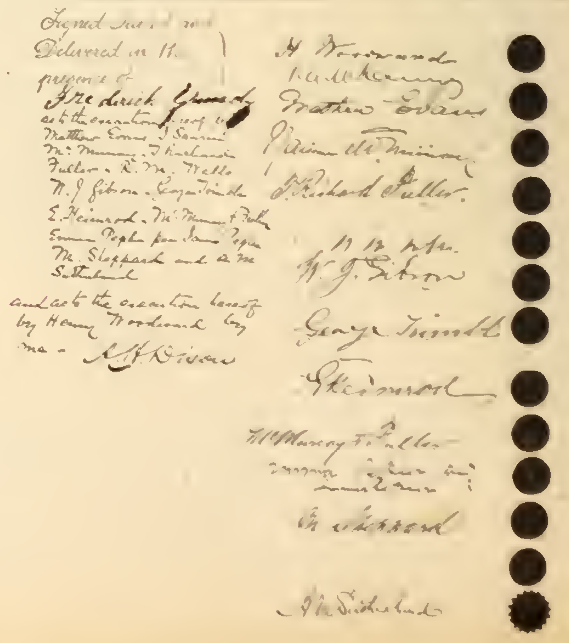
"Now this indenture witnesseth that, in consideration of the said additional subscriptions of five shillings to each of the parties of the first part, the receipt whereof is hereby acknowledged, the said parties of the first part, and each of them do hereby sell, transfer, assign and grant to the parties hereto of the second part their and each of their executors, administrators and assigns respectively, three thirty-fifth shares or parts in the said invention and letters patent in addition to the shares or parts granted and assigned by the said recited instrument.

"And whereas it is hereby agreed by all the parties hereto that the shares, parts or interests of all of the said parties in the said invention and in the letters patent therefor whenever and whereever the same may be issued, shall be as follows: the said Henry Woodward shall have own possession and be entitled to six thirty-fifth shares or parts; the said Matthew Evans to seven thirty-fifth shares or parts; the said James Saurin McMurray to seven thirty-fifths shares or parts; the said Thomas Richard Fuller to seven thirty-fifth shares or parts; and the said Rupert Mearse Wells, W. J. Gibson, George Trimble, E. Heimrod, A. M. Sutherland, Emma Peplar, M. Sheppard, and J. E. O'Reilly each to one thirty-fifth share or part, all of the said parties being joint and several owners and not partners, and for the purpose of more effectually vesting the said shares, parts or interests in the several parties entitled thereto, the said Henry Woodward hereby, in consideration of the premises, grants, transfers and assigns unto the said Matthew Evans, and to the said James Saurin McMurray, and to the said Thomas Richard Fuller, each of them their and each of their executors, administrators and assigns, seven thirty-fifth shares or parts in the said invention, and in the letters patent therefor, and to each of the following parties, namely, Rupert Mearse Wells, W. J. Gibson, George Trimble, E. Heimrod, A. M. Sutherland, Emma Pepler, M. Sheppard and J. E. O'Reilly their and each of their executors, administrators and assigns, one thirty-fifth share or part thereof, and the said Matthew Evans, James Saurin McMurray and Thomas Richard Fuller join and concur in the said grant or transfer to the said other parties and acknowledge the same to be valid and binding.

"And the said parties of the second part hereby agree to pay to the said parties of the first part each the sum of thirty-three ($\frac{33}{100}$) dollars, the receipt of the said Thomas Richard Fuller being a valid discharge therefor.

"And the said parties of the first part agree to use the said money exclusively for the purpose of procuring the issue of letters patent at Washington, and the said Henry Woodward hereby agrees after the issue of the said letters patent, to execute to the other parties hereto their and each of their executors, administrators or assigns, such further instruments and assurances for the better and more effectually conveying to them their said respective shares or interests as may be reasonably required or legally necessary.

In witness whereof the parties hereto have hereunto set their hands and affixed their seals:


Signed sealed and Delivered in the presence of
Frederick Grundy
as to the execution hereof by Matthew Evans J Saurin McMurray, T Richard Fuller, R. M. Wells W. J Gibson, George Trimble E. Heimrod, McMurray & Fuller Emma Peplar per James Peplar M. Sheppard and A M Sutherland
and as to the execution hereof by Henry Woodward by me - A H Dixon

H Woodward
Matthew Evans
J Saurin McMurray
T Richard Fuller
W. J. Gibson
George Trimble
E Heimrod
McMurray & Fuller
M Sheppard
A M Sutherland

Mr. A. M. Sutherland, one of the signers of the above agreement, in response to the request of a relative in Toronto for information on the subject, wrote as follows :

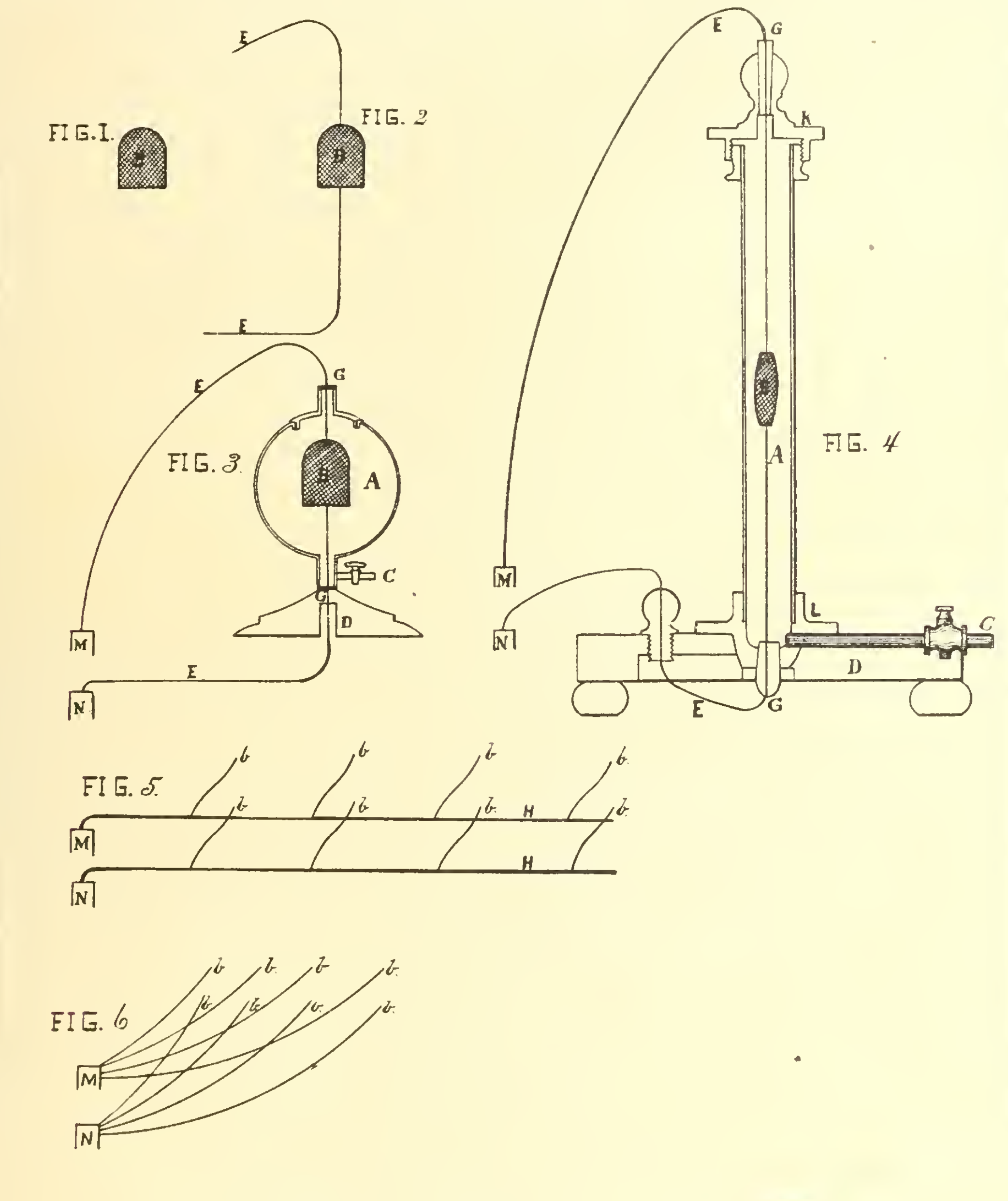
64 Carnegie Ave., East Orange, Nov. 24, 1896.

My Dear R——

M——tells me that somehow you came across a document signed by me some years ago showing some connection with electric incandescent light, and wishes me to tell you what I know of the matter. It is this. Somewhere between 1867 and 1875, I think it was, I was introduced by Mr. T. R. Fuller, a son of the late Bishop Fuller of Niagara, to a medical man named Woodward who was deep in the study of electricity. I was told that this gentleman had discovered two very important facts unknown to students of electric science, viz., the possibility of dividing the current, and the fact that placing a thin film of carbon between the poles in a circuit and enclosing the same in a vacuum would, by the incandescence of the carbon film produce a strong light. I recollected that a year or two before I had seen in the "Universal Exposition" at Paris a strong light shown by M. Gramme of that city, which was produced by an arc formed between the ends of two heavy carbon rods through which a very strong current of electricity was passed ; but the whole affair was so clumsy that I took very little "stock" in it. Therefore, when I heard that something neat and apparently serviceable was discovered by one near home, and that he wanted help to follow up his experiments and to obtain patents, I readily joined a number of friends and others and agreed to furnish the sum then supposed to be sufficient.

H. WOODWARD.

No. 181,613 ELECTRIC LIGHT. Patented Aug. 29, 1876.



WITNESSES

Geo T. Smallwood

John J. Roby.

INVENTOR

Henry Woodward

By- John J. Halsted
Attorney.

Two patents had been applied for in Washington at the same time for almost identically the same thing. One of these was Dr. Woodward's and the other was by a Russian whose name, I think, was Ladigan. Dr. Woodward and this Russian were declared in "interference" and had to fight each others' application before the patent authorities in Washington. Dr. Woodward won by proving priority of invention. After this it was found that so much money was required and apparently so little progress made towards completing the invention, that after our first investment, we decided to put in no more money until we could personally see the lights, which up to this time none of us had ever seen but had taken on faith. This displeased the inventor so much that he left for England and for years we knew nothing of his whereabouts. A few years after this I moved to New York, and in the course of business I was thrown into more or less intimate relationship with the now famous electrician, Thomas A. Edison, who was at that time experimenting with the electric incandescent lamp at Menlo Park, N.J. In talking about it one day, I chaffingly said : "Why Edison, you are nowhere ! I am part owner of a patent several years older than yours on about the same thing you claim." He asked what patent I referred to and I told him, he remarking : "O, I know that patent, it is no good ! The next day one of Mr. Edison's men, whom I knew very well, asked me how much I would take for my claim in the Woodward Patent, and that day I sold it to this gentleman, who in turn made over the papers to Mr. Edison. This is all.

Yours truly,
Sgd) A. M. SUTHERLAND."

UNITED STATES PATENT OFFICE.

Henry Woodward, of Toronto, Ontario, Canada, Assignor, Mesne Assignments, To Rupert Mearse Wells, Thomas Richard Fuller, and Ernest Heimrod, of same place, and Charles H. Woodward, of Lindsay, Canada.

IMPROVEMENTS IN ELECTRIC LIGHTS.

Specification forming part of Letters Patent No. 181,613 dated August 29, 1876 ; application filed Jany. 4, 1875.

To All Whom It May Concern :

Be it known that I, Henry Woodward, of the city of Toronto, county of York, in the province of Ontario, Canada, have invented new and useful improvements in the art or process of obtaining artificial light by means of electricity ; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

In the first place, I use a gas engine or other suitable motive power, for the purpose of rotating a magneto-electric machine, and at such a velocity as shall create electricity sufficient to heat certain pieces of carbon hereinafter described. The magneto-electric machine should be of sufficient power for the purpose of heating the carbon to a state of incandescence. A piece of carbon of suitable size is scraped and shaped until fitted for the purpose ; one pole is then attached to the top of the carbon, and the other to the bottom thereof, by suitable electrodes. It is then enclosed in a globe or other vessel, either of glass or other suitable material. The air is then exhausted from the said globe or vessel after it has been hermetically sealed at the ends, and the globe is then filled with a rarefied gas that will not unite chemically with the carbon when hot. Electricity is now supplied, and in sufficient quantity to heat the carbon within the vessel to a state of incandescence. The rarefied gas previously introduced now becomes luminous, and constitutes the light herein designated as "Woodward's electric light."

This arrangement and process will give a light of any required intensity, and there is, practically, no limit to the number of lights that may be obtained from one magneto-electric machine.

In the accompanying drawings, the same letters of reference indicate the same parts in all the views, and also in this specification.

Figure 1 is an elevation or front view of a piece of carbon, and is marked B. It is supposed to be scraped and shaped until suitable for the required purpose.

Figure 2 is also an elevation or front view of a piece of carbon with the electrodes E.E. attached thereto leading to and from the positive and negative poles of the battery, one being attached at the top and the other at the bottom of the carbon.

Fig. 3, is a sectional elevation, showing a globe marked A, but which may be a vessel of any other suitable form. The prepared carbon, B, is also shown therein with the aforesaid electrodes E.E. attached thereto ; showing also a tube C, with an air-tight stop-cock, to be used in exhausting the air from the globe A, and for the injection of rarefied gas into the same ; showing, also, the hermetical sealing of said vessel at the ends G.G. of the tubes, and showing also the stand D.

Fig. 4 is a sectional elevation, showing the adaptation of another form of vessel, A. This drawing is on a larger scale, in order to show the manner of closing the ends of the vessel which is done by brass sockets ; that at the top being marked K, and that at the bottom being marked L ; showing also a carbon B, different in form from that in the other vessel, and having the two electrodes E.E. running to and from the poles N and M.

Fig. 5 is an elevation, showing one mode of connecting the various lights with the machine by means of two trunk wires or electrodes H.H. running from the positive and negative poles M and N of the machine, with branches b, b, &c., therefrom, to each light.

Fig. 6 is also an elevation, showing another method of connecting the lights with the machine, each light having a distinct wire b, running to each pole M N of the machine or battery. Having thus described my invention, I claim—A carbon B, in combination with a lamp or other suitable vessel, A, filled with rarefied gas, possessing the property of not chemically combining with the carbon when in a state of incandescence, in connection with the described arrangement and mode of connection of the electrodes E.E. with the carbon, all as shown and set forth.

HENRY WOODWARD,

Witnesses { WILLIAM FITCH,
GEORGE T. SMALLWOOD.

The first incandescent lamp was constructed at Morrison's Brass Foundry, Adelaide St. West, Toronto, and was a very crude affair. It consisted of a water gauge glass with a piece of carbon filed by hand and drilled at each end for the electrodes and hermetically sealed at both ends, having a petcock at one end with a brass tube to exhaust the air. Woodward made the mistake of filling the tube or globe of this lamp with nitrogen after having exhausted the air. If, as Professor Elihu Thomson has said, he had stopped when he had the tube exhausted, he would have had the honor of being the inventor of the incandescent light as used for commercial purposes.

Six of these primary lamps were made up and connected in series. Evans was accustomed to tell of the excitement which attended the watching of these lamps coming to incandescence. To use his own words, "There were four or five of us sitting around a large table, Woodward at the head. The six lamps were strung in series from two supports on the table. Woodward closed the switch and gradually we saw the carbon become first red and gradually lighter and lighter in color until it beamed forth in its beautiful light. This was the most exciting moment in my experience." Evans was also accustomed to express the opinion that the inventor never gets the reward of his labor, and that by right he should have been the man to reap the benefit of this invention, in the perfecting of which he had expended $20,000.

As the result of his experiments, Woodward decided that a much stronger battery would be required to obtain the desired effect, and in company with Evans he went to New York City to see what they could obtain in the shape of a stronger machine. Finding that such a machine could not be obtained in New York, Woodward was dispatched to Paris to obtain, if possible, from M. Gramme a machine that would do the work. He was absent four months and succeeded in purchasing a machine from Gramme which he shipped to Toronto by sailing vessel. The arrival in Toronto of this machine gave rise to much excitement among the electrical fraternity of that day. The machine stood about four feet high and cost £500. One of similar capacity could be bought to-day for $35.

The machine was first tested on the premises of a hardware company on King St. West, near the Gurney Foundry Company's premises. Permission was obtained to couple the machine on to a line shaft which was propelled by a 60 h. p. engine, but on attaching a single light to the dynamo the engine was immediately shut down or the belts thrown off. Finally the machine was made to run successfully a single arc lamp which, as above stated, was of very crude construction and was controlled by hand feed. The machine was supposed to have a capacity sufficient to operate 50 incandescent lights. The single lamp, backed by a reflector, gave out such a strong light that Evans declared that the street car horses stopped opposite the building in which it was, while people from the surrounding neighborhood ran over to the factory, thinking it was on fire. The machine, however, would never run more than one light at a time. This first arc lamp was invented by Woodward also, and is said to have been manufactured by a machinist named Nesbitt. Woodward and Evans were the subject of much public ridicule, being frequently called "cranks." After the invention had been thus far tested, outside capital was obtained, and a company formed for the supply of incandescent and electric lights to the city and private individuals. It is interesting to note from Mr. Sutherland's letter that some of the original stockholders put money into the enterprise before having ever seen the light, and that when they declined to put up more money on the same conditions, Woodward became much displeased and left for Europe.

Dr. Woodward is said to be now residing in London, Eng., while Mr. Evans, who was his partner, and whose portrait accompanies this article, died in Toronto last year.

We are indebted for much of the above data to Mr. J. J. Wright, manager of the Toronto Electric Light Co., and Mr. Patriarche, of the Electrical Maintenance Company, Toronto, who sometime ago purchased the original of the agreement printed above, and other documents relating to the subject.

QUESTIONS AND ANSWERS.

Subscriber writes: Will you kindly answer the following questions in the next issue of THE ELECTRICAL NEWS:

1. What is the situation of Shawenegan Falls, where the new power plant is to be located.

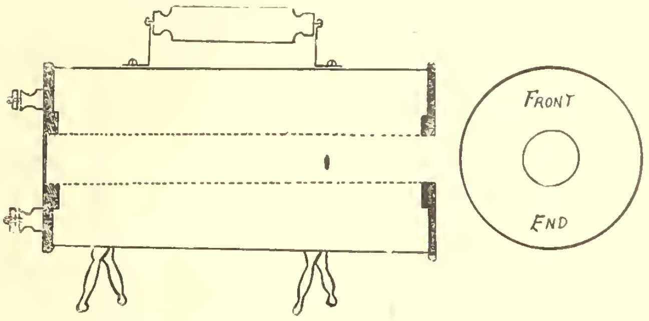
2. Where did the name of "Bus-bar" originate, and why is this term used? I have noticed that English electrical papers term it "Ominbus-bar."

3. What length and size of wire would be required for winding a curling tong heater for 114 volt circuit?

ANSWER.—1. The St. Maurice river, as is well known, is one of tne most important northern tributaries of the St. Lawrence, emptying into it at Three Rivers, Que. Seventeen miles from the mouth of the St. Lawrence is located Shawenegan Falls, where the water power development has been undertaken. These falls are, therefore, about 90 miles distant from the city of Quebec and 4½ miles from the line of the Great Northern Railway, while the Canadian Pacific Railway passes within ten miles of the falls. A map showing the proposed development of the falls appeared in THE ELECTRICAL NEWS of March, 1899.

2. It is difficult to say just where the name "Bus-bar" originated. It was used in the early days of the incandescent light and signified the common bar to which the terminals of all dynamos were attached and from which all circuits extended. The word is shortened from omnibus, which is Latin, and the dative case of the pronoun omnes, signifying "all." Omnibus, therefore, is literally "for all." Hence also its application to the well known vehicle of that name.

3. If our correspondent will take about 35 feet of No. 24 or 25 B. & S. gauge German silver wire, wind same on a piece of brass tube of sufficient diameter to admit of entering the tongs, and sufficient length to admit of their heating ends, previously wrapping the pipe over with a layer of asbestos cloth, he will then have accomplished the bulk of his task. The wire, of course, should be uninsulated, and space should be left between each convolution as it is put on. The wire will have to be drawn on quite tightly (not sufficiently so to cut through the asbestos), as it will expand slightly when the current is on. As all the wire will probably not go on one layer, repeat the process, that is, cover the first coil with asbestos and wind back on top again, and so on until the length of wire is all coiled. Bring the start end and finish end to binding posts on the outside of the outer shell, said binding posts being insulated from the shell with mica washers, and mica or fibre tube around the screw. If the bare wire comes close, or if you require to make a cross-over, use pieces of clay pipe stem to insulate one from another. When finished the coil should have an outer layer of asbestos, and any further space can be filled up with asbestos clippings so as to keep the heat in as much as possible. The accompanying sketch shows the finished article, dotted lines showing inner tube on which asbestos and German silver wire are placed. It will be observed that the whole can be made out of brass tubing of suitable diameter, and the ends cut from thick brass sheet. Do not solder anything, as it will melt ; tap and thread one into the other, or fasten pieces with machine screws.



NOTE.—An easy method to ascertain the amount of wire required for any heating device is as follows: First determine on a size that will not take too much current for the work to be done ; then stretch out a quantity (be sure there is not too much) on pins spaced along a board, take wires from current supply, attach one to one end of this spaced out German silver wire, use the other end as a sliding contact, beginning at distant end and sliding it along the wire, which, of course, becomes hotter and hotter as resistance is being cut down, until the wire assumes a blue shade owing to heat. Stop then, and cut off the piece between the current contacts and use it for your heater. When enclosed from air it will be hotter, therefore we advise stopping when it assumes the blue shade.

PERSONAL.

Mr. James A. Hicks has been appointed electrical inspector in Montreal for the Royal Electric Co.

Mr. J. M. Clark, a director of the Smith's Falls Electric Light & Power Co., and a prominent business man of that town, died last month.

Mr. George White-Fraser, E.E., has returned to Toronto, after an absence of more than one year in the Yukon district on a government commission.

We learn with regret of the death, on January 9th, of Mr. Jas. D. Smith, of this city, father of Mr. J. Norman Smith, electrical engineer of the United Electric Co., Limited.

Mr. R. A. Ross, of Montreal, consulting electrical engineer of the C.P.R., recently left for Rossland, B. C., to inspect the plant installed at the company's round house there.

Mr. Joseph Lappin has resigned his position as electrician for the Metropolitan Railway Company, of North Toronto, and is now in the employ of the Canadian General Electric Company.

Mr. D. A. Shiles, traffic manager at Vancouver for the British Columbia Electric Railway Co., has been transferred to New Westminster, as local manager there, and is succeeded by Mr. J. J. Franklin.

Mr. Mark. B. Thomas, who was manager of the Hamilton & Dandas Railway, which road has passed into the hands of the Cataract Power Co., has been appointed to a responsible position in connection with the street railway system of this company.

Archibald Rowan, inspector of gas and electric light at St. John, N.B., died in that city on January 10th, at the age of 70 years. He was appointed to the above position in 1875, previous to which time he had been prominent in civic affairs and a candidate for the mayoralty.

Mr. Herbert J. Somerset, manager of the Winnipeg Electric Street Railway, has accepted a lucrative position as general manager of the tramways at Perth, West Australia. Mr. Somerset was much esteemed in Winnipeg, and carries with him the best wishes of numerous friends.

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Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Electric Light Invention in Canada.

WE are privileged to publish in this number some interesting data regarding the history of the invention of the electric light. Canadians will no doubt be surprised to learn that the principle of incandescent electric lighting was discovered in Toronto prior to the time when Edison's invention was placed before the public, and that this Canadian invention was sold to Mr. Edison, and were no doubt used by him in the further exploitation of his inventions and discoveries. We are largely indebted for this interesting data to Mr. J. J. Wright, manager of the Toronto Electric Light Company, himself a pioneer in the electric light industry, and to Mr. Patriarche, manager of the Electrical Maintenance Company, who secured much of the information by personal interviews with Mr. Matthew Evans, one of the original promoters of the discovery. It is gratifying to learn that Canada is not only the scene of some of the greatest achievements in the applications of electricity, but is also the home of some of the most important discoveries relating to the science.

An Incident in Electric Lighting.

THE accident which caused the death of Mr. Alphonse Girouard, and which is referred to by our Montreal correspondent is, to say the least, peculiar, and so far as the electrical fraternity is concerned, no entirely satisfactory explanation has been given. It appears that two rival electric lighting companies had their primary alternating lines, operating under a pressure of 2,000 volts, in close proximity. This voltage in some way came in on the secondary mains, which normally were at 52 volts. The theory is advanced that the primary wire came in contact with a guy wire, and this in turn with secondary supply wires, bringing the 2,000 volts in on one side. In order to permit of the accident, the inside wiring must have been grounded, so it is surmised that the deceased stood on an iron rail in front of the hotel bar to raise himself up sufficiently to grasp the socket. Rain was falling and a strong gale of wind blowing at the time, and it is possible that the wind may have blown the dangerous wire into contact, as the trouble patrols were unable, shortly after the accident, to find high voltage in the premises. It has not been ascertained whose primaries caused the accident or how they came in contact with the secondaries. The transformers are reported to have been in good order. The accident is unfortunate, as it already has had a tendency to make customers afraid to turn on their sockets. It may truly be said, however, that the peculiar combination of conditions which resulted in this accident will very rarely be met with, and are almost impossible in dwelling houses. Nevertheless, it is in the interest of electrical progress that the matter should be thoroughly investigated and all the facts concerning the case placed fairly before the public. This will be the best means of dispelling prejudices against electricity based upon erroneous versions of this accident.

Central Station Practise.

THE address of the president of the North-Western Electrical Association, delivered at the eighth annual convention held in Milwaukee on January 17th, contains food for thought for central station managers. His remarks were confined to a review of the conditions surrounding the operation of central stations. The changes in practice to which he refers have had practical demonstration in Canada as well as in the United States, and the suggestions offered regarding operating methods are likewise applicable on this side of the border. Sketching the progress made in central station machinery, Mr. Doherty expressed the opinion that the constant current transformer is here to stay, and that street illumination by series alternating enclosed arc lamps is a decided improvement over the old series direct-current open arc. The distribution of light is materially improved and a more uniform illumination obtained. Instances are cited where two central stations had adopted gas engines as prime movers, using sizes as high as 650 h.p. It might be mentioned that in Ontario the Sandwich, Windsor & Amherstburg Railway Company have just installed a 150 horse power gas engine for operating their electric road, to replace a Corliss steam engine. The president referred to the necessity of a better distribution of street lighting, and his opinion is that this may be accomplished by the greater use of the incandescent lamp. He thought there had been little improvement in the past few years in direct current methods, but this could not be said of alternating current appliances and methods. In the past, "unaccounted for current" in alternating current stations had often amounted to 80 per cent. of the output, but modern transformers, up-to-date methods and equitable rates promised to reduce this loss to an almost negligible quantity. The average central station was handicapped for four reasons, namely, improper and insufficient education of operators, poor accounting, lack of capital, and inequitable rates. He strongly recommended the further education of present employees. When speaking of employees, Mr. Doherty might have gone further and said that the remuneration which is sometimes given to those in charge of electrical apparatus is not such as could be expected to induce such persons to put forth their greatest efforts towards self improvement and the welfare of the business. The subject of municipal ownership was discussed at some length. The conclusion reached was, that the main protection against municipal control lies in educating the people with regard to its fallacies.

The Proposed Dodge Telephone Company of Canada, Ltd.

WE have had the opportunity of examining the prospectus of the Dodge Telephone Company of Canada, Limited, and the circular letters accompanying the same. Some of the features of this prospectus seem to call for particular mention and enquiry. The first of these is, that, while the company has not yet been granted a charter or completed its board of directors, it is soliciting from the public applications for stock, such applications to be accompanied by a deposit of 10 per cent., a further payment of 25 per cent. to be made upon allotment, and the balance subject to call as required. These deposits accompanying applications for stock will, it is stated, be deposited in the Imperial Bank of Canada in Toronto in the name of the trustee of the proposed company. We do not observe that the name of this trustee is printed in the prospectus. The only names there printed appear to be those of the bankers, the solicitors, and the promoter of the proposed company. Can a company thus organised legally accept applications for shares and payments on account of stock thus applied for? The prospectus states: "The ordinary telephone system has been materially improved by Mr. Burton R. Dodge, of Post Mills, Vermont, an inventor of marked ability, and a gentleman possessed of a lengthy experience in the practical operation of telephone lines. These improvements are completely protected by patents; the number of his Canadian patent being 60,912, and of the United States patent 606,803. And it is now proposed to incorporate a company under the Joint Stock Companies Act to operate Mr. Dodge's improved invention in the city of Toronto, and elsewhere in the Dominion of Canada, with the ample capital of $3,000,000, divided into 3,000,000 shares of one dollar each. One-half of this gross number, or 1,500,000 shares, will be set apart in 8 per cent. fixed, cumulative preference shares dividends payable half-yearly; and the remainder, the other 1,500,000 shares will be written as ordinary stock under the direct control of Mr. Burton R. Dodge, his heirs, or assigns." If we rightly understand the meaning of the latter clause of the above paragraph copied from the prospectus of the proposed company, the purchase by Mr. Burton R. Dodge of a single share of stock, in addition to the 1,500,000 shares which are to be transferred to him in exchange for the use of his patents, would give that gentleman entire control of the company. This understanding of the terms of the prospectus seems to be verified by the following additional clause in the prospectus: "A rapacious and unscrupulous monopoly has in various instances elsewhere destroyed all immediate chance of competition, either by buying up a controlling interest in the stock, or by paying a lump sum for the stoppage of the business; and with the view of preventing such a culmination in connection with the operation of this company, Mr. Dodge will retain the controlling interest in the stock." Another clause to which we desire to direct attention reads as follows: "All applications for shares should be made upon the form attached to this prospectus, and should be promptly forwarded to the bankers of the company, together with the ten per cent. payable on application. But if no allotment of stock be made, such deposit shall be returned less such expenses as may be incurred up to that time." It is here clearly stated that the company assumes the right, even in cases where no allotment of stock is made, to retain such amount of the applicant's deposit as may be considered necessary, to be applied to the payment of expenses incurred. What is to regulate the amount of the expenses, and what guarantee has the applicant that the whole of his deposit will not be held by the company and applied to expense account? What right has a company to retain the money of an applicant whose application for stock has not been granted? The form of application for stock reads as follows: "I hereby request that you will allot me .... shares of one dollar each in the proposed Dodge Telephone Company of Canada, Limited, upon the terms and subject to the conditions mentioned in the prospectus." Thus, the applicant for stock, when signing his application agrees that the stock shall be issued "upon the terms and subject to the conditions mentioned in the prospectus." It would be interesting to learn how many applications for stock have been received by the promoters of this proposed company.

Mr. Thos. Jackson, for fourteen years manager at Stratford, Ont., for the Bell Telephone Co., has retired, owing to advanced years. He has been succeeded by Mr. J. H. Martin.

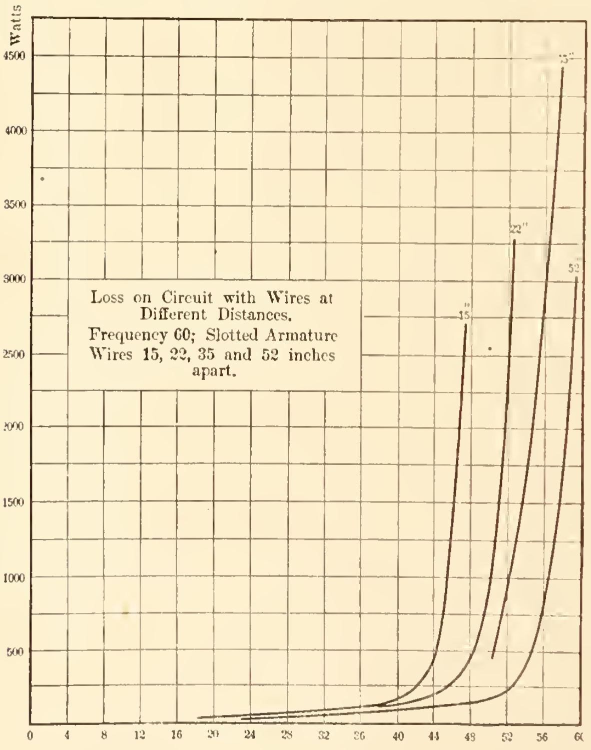
ELECTRIC POWER TRANSMISSION.

The publishers of the Electrical World and Engineer, New York, have issued a second edition of that valuable work "Electric Power Transmission," by Louis Bell, Ph.D., Mem. Inst. Elec. Eng. The first edition was printed in January, 1897, and was very favorably received, but the changes that have taken place since in the art of electrical power transmission called for another edition. The book contains fourteen chapters, classified as follows: Elementary Principles; General Conditions of Power Transmission; Power Transmission of Continuous Currents; Some Properties of Alternating Currents; Power Transmission by Alternating Currents; Current Reorganizers; Prime Movers; Hydraulic Development; The Organizations of a Power Station; The Line; Line Construction; Centres of Distribution; The Commercial Problem; The Present State of High Voltage Transmission. In this latter chapter is recorded such change in practice as has taken place during the three years intervening between the two editions. The most important advance, it is stated, has been in the matter of power transmission at very high voltage and to long distances.

By permission of the publishers we give below extracts from this chapter:

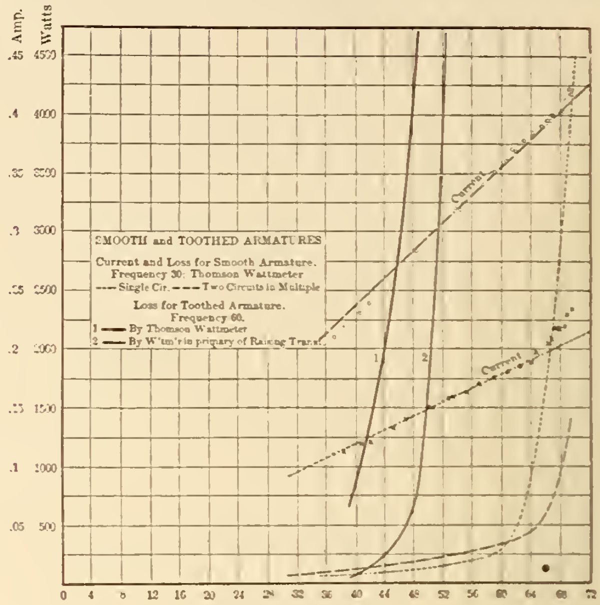
Much of our knowledge of the subject is due to the exhaustive tests made by Mr. Ralph D. Mershon at Telluride, Col. These are fully described in a paper by Mr. C. F. Scott before the American Institute of Electrical Engineers. Briefly, the essential points established are as follows:

With first-class glass or porcelain insulators there is little to fear in the way of leakage in good weather up to say 50,000 volts, unless the insulators break from mechanical causes. Rain and snow seldom cause trouble, although of course they may do so. Dry air, snow and clean water are tolerable insulators, although dirt of any kind on the insulators is to be feared. Cross-arms and pins should be filled to prevent infiltration of moisture. There is good reason to believe that oil insulators are quite needless, and they certainly are apt to accumulate dirt without giving any compensating advantage.



Thousands of Volts.
FIG. 1.

Loss of energy through leakage over the surface of the insulator is very trifling perhaps not more than two or three watts per insulator, even at 50,00 volts between lines. In bad weather this is likely to increase; but the leakage itself tends to dry the surface of the insulators, and while if high voltage is suddenly thrown on a line leakage may cause immediate trouble, gradually raising the pressure to the full working point tends to correct this difficulty, and there is no trouble experienced. Rain is the only thing likely to cause difficulties, unless we except a heavy snow storm, and neither is much to be feared at 40,000 to 50,000 volts, although above this point troubles increase rapidly. A heavy sea-fog, with salt-laden atmosphere, is serious, however, as has been shown on lines of far lower voltage than the above, and sometimes has caused the burning of pins, cross-arms, and even poles. Sappy cross-arms and poles have been a not uncommon source of damage.



Thousands of Volts.
FIG. 2.

The most interesting fact brought out in the Telluride experiments was the leakage at very high voltage between wire and wire through the air—a true brush discharge akin to that seen about the wires proceeding from a big induction coil. At about 20,000 volts the line wires begin to show at night traces of luminosity, which rapidly increases with the pressure, until at 50,000 volts and upward the wires are plainly visible for a long distance, and the hissing sound characteristic of fierce brush discharges is audible at the distance of a hundred feet or more. This discharge involves a real and quite considerable loss of energy, increasing with appalling rapidity at still higher voltages. This loss increases with rise of voltage, with diminution of the distance between wires, and with diminution of the diameter of wire. Anything on or about the wire which increases the electric density at any point shows as a noticeable brush discharge. Fig. 1 shows the loss on the Telluride circuit, 2¼ miles in total length, with line wires at different distances apart on the poles. The curves begin to turn upward at between 40,000 and 50,000 volts, and, once the elbow of the curve is past, rise very fast.

It is clear that this phenomenon sets a real physical limit on high-voltage transmission of a sort not hitherto realized. A loss of say 2 k.w. per mile of wire is a pretty serious matter on a long line, even when the total energy transmitted is very considerable, and obviously in any practical case of transmission the voltage must be kept well below the elbow of the leakage curve. Hence the wires should be kept well apart.

As might have been expected, the shape of the E.M.F. wave given to the line is a very important matter under these circumstances. Fig. 2 illustrates this fact in a sufficiently startling manner. By changing from a non-sinusoidal wave of the peaked type to a wave nearly sinusoidal the elbow of the curve was pushed up from 40,000 volts to 60,000 volts under conditions otherwise the same. For such work there is every possible reason for using the sine wave on account of this leakage effect as well as for other practical reasons already set forth. But even with favoring conditions leakage must be reckoned with, and present data indicate that in nearing 50,000 volts one is on dangerous ground quite aside from any questions of insulators or apparatus. We cannot expect to improve the dielectric strength of the air, and although the conditions may be improved by using good-sized wires when conditions permit, or perhaps by heavily insulating the wires, thus both increasing their diameter and somewhat improving the general insulation, it is quite probable that a limitation of voltage from this cause is an unpleasant reality.

With proper precautions, however, there seems to be no very grave difficulty in working at 40,000 to 50,000 volts. Besides the Telluride experiment, in which the short line mentioned was worked steadily for a month at 50,000 volts without serious interruptions, there has now been in operation for over a year a commercial transmission over 55 miles at a working pressure of 40,000 volts. This is the plant of the Telluride Transmission Co. at Provo, Utah. The power is utilized for driving the Mercur mills and other work in connection with a large mining property. The generating plant consists of a pair of 750 k.w. three-phase generators, directly connected to turbines. They run at 300 r.p.m., giving 60 alternations, 800 volts. The raising transformers of 250 k.w. each are set up in the star connection with the neutral points of both primary and secondary grounded. The line involves a rather tough bit of mountain construction, reaching an extreme altitude of over 10,000 feet. The insulators are of glass and of ample dimensions, 7 inches in diameter.

This plant has done good steady work ever since it was started. It has not been exempt from troubles, of course, but there have been no serious breakdowns.

In ordinarily dry weather the line has uniformly worked well—as well as lines at a much lower voltage. In rainy weather there has been some trouble from leakage, sometimes enough to blow the fuses. In almost every instance of line trouble the cause has been found to be a broken insulator—cracked from strain or smashed by a bullet. The first time the author crossed the continent on power transmission business he received a vivid idea of the bullet as a factor in the situation, for nearly every switch target between Kansas City and Los Angelos had from one to a dozen bullet holes in it.

The Provo plant has been in operation since February, 1898, and in spite of the terrific voltage and occasional difficulties on the line it has done, and is doing, exceedingly good service. Such pressure, however, must be regarded as somewhat experimental, and it should be borne in mind that the kind of work on which it is employed is such that trivial disturbances are not noticed much, and brief interruptions at infrequent intervals are not serious—simply annoying. What a similar plant would do in the way of furnishing a general service of light and power is still problematical.

An innovation which has found some favor is the use of generators wound to deliver directly 10,000 to 12,000 volts. Such machines are always built with stationary armatures and revolving fields. Prior to the introduction of this construction. generators for such pressures were out of the question, but there are now in use eighteen of these high-voltage machines, nearly all above 500 k.w. capacity, which are uniformly doing good service. The ultimate economy of this practice is not yet clear. One set of transformers is saved, reducing the loss about 2.5 per cent., while on the other hand the very large insulation space required tends to considerably reduce the capacity of generators of given dimensions. Exact figurrs cannot be had, since the intrinsic merits of the matter are mixed up with commercial considerations involving the competitive and advertising value of novelty, the question of adaptation of standard sizes and speeds, and other matters which are of temporary rather than permanent importance. It is the author's impression, however, that when these matters are eliminated there will prove to be little or no difference in cost, including depreciation and efficiency, between the high-voltage machine and a low-voltage one plus the raising transformers. At present, inasmuch as the high-voltage generators are excellent and reliable machines, their use is advantageous so long as a good bargain can be driven as to price as compared with the low-voltage machine and its raising transformers. Although none of these high-voltage generators have been long enough in use to get a definite idea of their liability to electrical troubles, there is not much to be feared in view of our present knowledge of insulation.

The phenomena of line capacity and inductance, resonance, unbalancing of three-phase transmission circuits, and divers other unpleasant things which are theoretically present on long-distance or high-voltage lines, have been shown by experience to be of no sensible account in a well designed and constructed plant. Line inductance and the rest are, of course, always with us, but from an operative standpoint they are not at all serious at any pressure or distances now in use. They must be considcred and taken into account just like ohmic resistance and line insulation, but are not material obstacles at any voltage or distance yet tried.

As regards the generation and distribution, the work in this country is about equally divided between the two-phase and three-phase systems, the latter being rather in the majority. As might be anticipated, there is found very little difference in the general properties of the two systems, the tendency being to use two-phase in many cases where an existing alternating lighting system is to be supplied, and three-phase for heavy motor work or when the whole system is installed de novo, although neither this nor any other plan is consistently adhered to in practice.

The generating and transforming units have been steadily increasing in voltage and capacity. Some 2,500 k.w. transformers have recently been ordered for the Niagara plant, while those of several hundred kilowatts are common enough. Barring the general objection to putting too many eggs in one basket, this tendency is a good one, giving units at once cheaper and more efficient.

Accessory apparatus has hardly kept pace with the general progress of the art. Switchboard appliances for high-voltage work are notably undeveloped into standard forms. They have particularly suffered from the too common straining after compactness. A liberal factor of safety is always a good thing, and nowhere is it more necessary than in dealing with voltages such as are used in electrical power transmission.

The question of frequency is gradually settling itself. Except in plants intended mainly or entirely for use with rotary converters, a frequency of about 60 alternations is the general rule, and this is the figure adopted in the great majority of transmission plants. In those intended for general distribution of power and light, the lighting sets a lower limit to the frequency that must be respected. In the neighborhood of 30 alternations incandescent lighting becomes decidedly troublesome, and if alternating arcs are to be used the frequencies must be kept above 40 alternations. On the other hand, induction motors give the best results at moderate frequency, say not over 50—60 alternations at the most. All these facts point to the advisability of keeping within moderate limits, and the usual 60 alternations is for moderate distances and ordinary distributions very satisfactory. In the writer's judgment, it is rather high for heavy long distance work 45 or 50 alternations would be rather better, but there is no excuse whatever for going as low as 30 alternations except when rotary converters are the principal load and no lighting whatever is to be done for the transmission lines.

In this connection it is well to call attention to the fact that alternating arc lamps, particularly of the inclosed type, are now in a fairly satisfactory state, and that the series arc is being very largely replaced by constent-potential arcs, often inclosed, working off the ordinary lighting system. It therefore appears probable that special devices for arc lighting will form a less troublesome feature of transmission work than hitherto.

The induction motor has come into wider and wider use as transmission plants have increased in number, and particularly the larger sizes have been well developed. These very large induction motors are particularly valuable for hard service and starting with considerable loads, although in view of the value of synchronous motors in improving the power factor of transmission plants, these latter machines are not likely to be entirely superseded.

MONTREAL

Branch Office of the Canadian Electrical News,
New York Life Building,

February 6th, 1900.

The Star's recent editorial anent recent civic elections is all very well in its way, but some of the "electrical" items in same are worthy of comment. Take overcrowding of cars: This is the "whole truth and nothing but the truth," and the systems at Ottawa, Quebec, and Toronto simply make Montrealers ashamed of their's. To see a car going up Windsor street hill with the back platform so overwhelmed with humanity as to cause the rear fender supports to scrape on the cobble stones (in some cases even the rear lower step is scraping on the ground), is disgraceful, to say nothing of the rear motor then doing 70 per cent. of the work and the front motor nearly lifted off the rails. To say that the public won't stop getting on is absurd; if the conductor refuses to move his car until late crowders step off, the balance of the passengers inside would probably take care of the result; if not, then call a policeman, and in Montreal—CALL LOUD. Then cheap light. This item deserves a word of protection for the illuminating companies. As to public arc service it is an open rumor that it cost so much to secure the contract that even at alleged high figures there has not been much profit in it for the company who got it. Taking the incandescent service, it is well known that there are two large competing companies, both basing their price list at ¾ of a cent per ampere-hour at a pressure of 50 volts, one company offering a cash discount of 33⅓ per cent., and the other 40 per cent. Surely there is not much to complain of here, and I think other cities will agree with this, and wish they were as well fixed. The question of power rates for motors has not been touched upon, but here again there is little or no cause for complaint. We may be higher than some other cities for small power units, say from ½ to 3 h. p., but for large powers we are certainly as good, and for extra large motors away better off. Lastly, be it remembered that our city council are doing their best to tax everything, almost down to the glass insulators and tie wires.

A shocking accident was that which resulted in the death of Alphonse Girouard a hotelkeeper, doing business at 176 Vinet street. It seems that the wife of the deceased, while about to turn on an incandescent light, felt a slight electric shock. Calling her husband, she asked him to turn on the light. He had no sooner taken hold of the lamp than he sank down with a groan. The electric current held him so fast that the assistance of three men was required to extricate him. Before a physician arrived he had expired. The accident is attributed to the crossing of a high pressure wire with the wire which entered the house of the deceased. An examination of the premises failed to disclose the cause of the accident, and it is more than likely that this matter will never be fully explained, as well as others, such as: why insurance inspectors should be so particular as to fire risk without looking at life risk; why lighting companies should be so careful to have porcelain tubes, etc., yet not look out for "grounds;" why the process of resuscitation is not resorted to, and promptly, to persons hurt in this manner.

The Bell Telephone Company have lately installed a private exchange for the Merchants CottonCompany in this city; the signals in some departments being inaudible owing to the rumble of machinery, here take the form of a relay drop closing a circuit through a red lamp, thus making a visual signal that party is desired.

It would be interesting to know just what is the longest distance we can talk to direct over the Bell Telephone Company's wires with success. Perhaps some of the readers in their employ will enlighten us. In a recent advertisement the Bell people couple Quebec with Omaha and Montreal with Key West, which, of course, can be taken "cum grano salis," but if going in for "so much" they might as well be killed for a sheep as a lamb, and make it Winnipeg with Valparaiso.

The order for a 600 k. w. D.C. A.C. generator, secured by the Westinghouse people from the Quebec Street Railway and Light and Power Co., has been filled. It is understood that this generator will be installed at the power house adjacent to Montmorency Falls and utilized to run the trolley road to St. Annes de Beaupre, that is, as soon as the old Quebec, Montmorency and Charlevoix Railway is arranged for electric transportation instead of steam. The generator in question is said to stand 14 feet in height. A "rotary" will probably be placed at the St. Annes end of the line, with usual step-up and step-down transformers for suitable voltages.

The astonishing electrical activity last fall (as foretold by your correspondent) is only now beginning to abate. The mild weather was a boon to construction firms, as it is impossible to expect wiremen to get through the usual amount of work in a given time with their fingers half frozen. Complaints as to fall business are not forthcoming from either the supply men or construction firms, and the outlook for the balance of the winter (generally a slack time) is more favorable than is usually the case.

Instead of the expensive alarm clock bell ringing outfits, if one with any knowledge of electricity will only remember that the winding thumb key on all nickle alarm clocks keeps turning when the alarm is ringing, he can easily use it to operate some form of circuit closer, and with the addition of a few feet of wire, a bell, and dry battery, have a good "awakener."

Would the Boers be "shocked" that the Hague Conference had overlooked this? Coulpe arc light dynamos used for the search light, in series, "to required voltage," ground one pole, and connect the other to the protective enclosure, viz., barb wire fence!

Square wire is coming into vogue largely for the purpose of increasing the kilowatt capacity of certain alternating generators which have machine wound coils, allowing of such an exchange being made. It is easily seen that the corners being filled in is quite an advantage over the ordinary round wire, and in many cases the gain is great enough to warrant going to the expense.

The dry goods establishment of Bernier & West, corner of St. Catharines and University streets, was recently damaged by fire to the extent of $30,000. The local press, as usual, announced that the fire was supposed to have been caused by electric wires. The report of the Fire Underwriters' Association, however, was that "there is no evidence to the effect that the fire was caused by electric wires; on the contrary, the fire seems to have started on the second flat in the vicinity of a sewing machine." The verdict of three experts, one of them perhaps the most capable man in the country on the question of electrical fires, was unanimous on the above point. If electrical firms would adopt some form of reprisal, say in the shape of cancelling advertisements, it might make certain newspapers who are so fond of ascribing fires to electricity without any proof, a little more careful.

THE TORONTO ELECTRIC LIGHT COMPANY.

The Toronto Electric Light Co. are about to enter upon a number of extensive improvements for the purpose of extending and perfecting their service.

They have recently purchased a block of land adjoining the east side of their present property, having a frontage of 150 feet on the Esplanade and extending 1,064 feet southward to the wind mill line. It is the intention to erect immediately on this land a large machine and repair shop, and a little later on a new power station in which will be installed direct driven units of single phase alternators, of 750 kilowatt capacity each, of the Canadian General Electric Co.'s type, for incandescent lighting.

The present machine shops will be removed to allow of the extension of one of the present power stations to accommodate four more Heine boilers with a total capacity of 1,500 h. p., one vertical marine type compound engine of 1,500 h. p. capacity, and a single phase alternator of 500 kilowatt capacity.

The company have had plans and specifications prepared for a steel steamer of 600 tons capacity, to be used for bringing coal from American ports.

LARGE ORDER FOR ELECTRICAL APPARATUS.

One of the largest and most interesting industries in Canada is that of the Dominion Iron & Steel Company, of Sydney, C.B. They purpose operating practically their entire plant electrically, and have just placed an order with the Canadian General Electric Company for a complete electrical outfit, consisting of: Three 500 kilowatt 250 volt direct driven generators; one 100 kilowatt Booster set, direct driven by motor; two 60 kilowatt single phase alternators, direct driven by motors, mounted on same base with alternators; three No. 12 125 light brush arc dynamos, direct driven by motors; 250 D. C. series enclosed arc lamps, and a complete equipment of marble panel switchboards and wiring supplies. This, together with an order for two 125 kilowatt direct connected units, recently placed with the same company, constitutes one of the largest orders ever given in Canada for electrical apparatus.

TELEGRAPH and TELEPHONE

THE COPENHAGEN "AUTOMATIC" TELEPHONE CALL BOXES.*

In December, 1898, the Automatic Telephone Company, of Copenhagen, began erecting telephones on the "penny-in-the-slot" principle. At the present date there are about 465 instruments connected to the telephone exchange, and this number is being gradually increased. These telephones are placed in nearly all public buildings and theatres, and also in a number of houses where people live in flats. The test of about a year's use has shown that these instruments are thoroughly reliable. The inventors are Mr. L. M. Ericsson, of Stockholm, and the manager of the Danish company Mr. Sophus Ritter. Compared with the call-box instruments employed in this country, the chief advantages of this system are :

1. The exchange can only be called up after a coin (10 ore, about 2½c.) has been dropped in; this prevents a deal of unnecessary trouble at the exchange.

2. In case the exchange cannot connect through, the coin is recovered by pressing a button.

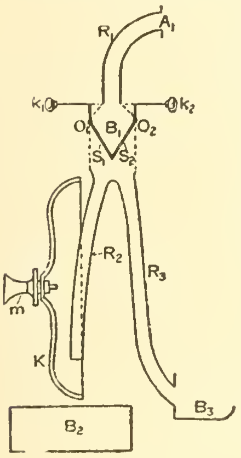


FIG. 1.

3. Ringing off is avoided, as this is performed automatically by replacing the receiver on the hook.

4. By special arrangements for receiving extra coins, telegrams can be forwarded through the exchange.

Fig. 1 shows arrangement for receiving the coin. This is dropped in at A_1, and passes through the flat tube R_1 into the receptacle B_1. S_1 and S_2 are two forks, pivoted on O_1 and O_2 and insulated from one another. When a coin is resting in B_1 it connects S_1 and S_2, thus completing the circuit through the magnets I to the exchange (see Fig. 2), and the latter can now be rung up in the usual way.

After receiving the caller's demand and making the engaged test, the operator at the exchange answers either "Connected" or "Engaged." In the first event the caller pushes the button k_1 and the coin drops through the passage R_2, strikes the gong K, and falls into B_2. The operator at the exchange hears the coin strike against the gong, and only then connects through. If the reply "Engaged" has been received, the button k_2 is pressed and the coin is returned through the passage R_3 into the box B_3 placed on the outside of the telephone, whence the caller can recover it.

The connections are shown in Fig. 2. When not in use the receiver hangs on the hook N, and contact is made between a_2 and a_3. The one pole of the magnets I is in direct connection with the line L_1, while the other line, L_2, is broken beeween S_1 and S_2. After a coin has been dropped in, the circuit through the magnets is completed through O, S_1, the coin S_2 O_2 a_1 Na_2, and a_3 to line L_2, and the exchange can be called in the usual way. On taking the receiver off the hook N the circuit is broken between a_2 and a_3, and contact is made between a_6 and a_7, and the connections are the same as in a usual telephone.

When the receiver is replaced on the hook the line L_2 is connected through a_4 and a_5 to earth, and the clearing signal is given automatically at the exchange ; this is arranged on the "ringing through" principle.

Telegrams are telephoned to the operator at the exchange, and he telephones the amount to be paid. The necessary coins are then dropped through two slots at the right-hand top corner of the instrument ; on their way they strike against gongs, by means of which the operator can control the amount paid in.

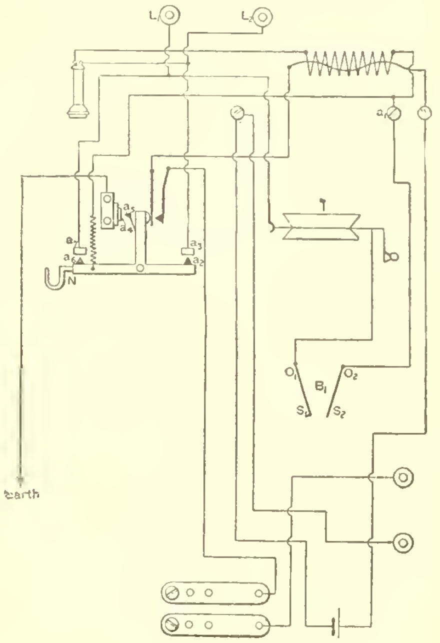


FIG. 2.

The apparatus is mounted in oak cases, and on the outside of these are illustrated instructions for the public.

AMERICAN TELEPHONE PRACTICE.

The above is the title of a very valuable work just issued by the American Electrician Company, 120 Liberty street, New York. The author, Mr. Kempster B. Miller, M.E., is recognized as an authority on telephone matters, and has presented in a concise manner the general principles of telephony, the design and construction of commercial apparatus, the circuits connecting such apparatus into operative systems, and the methods used in the construction, operation and maintainance of these systems. The book contains 458 pages, divided into 33 chapters and containing 357 illustrations. The subjects treated include : History and Principles of the Magnetic Telephone ; The Telephone Receiver ; Transmitters ; Batteries ; Commercial Calling Apparatus ; Self-Restoring Switch-board Drops; Transfer Systems ; House Systems ; Distributing Boards ; Overhead and Underground Cable Construction, etc.

The Dominion government has decided to proceedat once with the construction of the telephone line from Atlin to Quesnelle, to connect with the eastern telegraph system, so that messages can be sent direct by wire to Dawson. Mr. J. B. Charleston will have charge of the work.

The Bell Telephone Company have recently made improvements in their exchange at Acton, Ont., having installed a new combined local and long distance switchboard and made other improvements. The work was executed by Messrs H. E. Fairbank and Joseph Curzon. The local manager is Mr. A. T. Brown.

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*From the Electrician, London.

ENGINEERING and MECHANICS

ICE, NATURAL AND ARTIFICIAL, AND REFRIGERATING MACHINES.*

By E. J. Philip.

Ice is the solid crystalline form which water assumes when exposed to a sufficiently low temperature. Natural ice assumes different forms, such as hoar frost, snow, hail, and as we usually see and recognize it in sheets of ice on our rivers and lakes. Natural ice is also to be seen on a gigantic scale in glaciers and icebergs far north. To give an idea of the gigantic scale in which nature works in the matter of ice-making, an iceberg observed by Sir John Ross and Lieut. Peary was 2½ miles long, 2 1/5 miles broad, and 153 feet high. The mass above water was apparently 150 million tons, and the total mass, calculated from what appeared above the water, must have been 1,500 million tons, and this was not an unusually large berg. You will see by this that nature does what we cannot do.

I will give a short description of the manner in which ice forms and show the wise provision of Providence in connection therewith. As the temperature of the air falls the surface water in a lake or river gradually cools; as it cools it becomes heavier and sinks, due to the laws of expansion and contraction. The warmer water takes its place and is in turn cooled and sinks. This process goes on until all the water in the lake reaches a temperature of 4° C. or 39.1° F. At this point water has reached its maximum density; if its temperature continues to fall it will expand. In cooling from 4° C. to zero, the surface water cools first, expands, and remains on top. This is surely a wise provision of Providence, for if it was not for this exception to an almost universal rule, all our rivers and lakes would freeze at the bottom first and the accumulated heat of summer would never thaw it out, because it would only melt a little on top, and then, as it got warmer, it would expand and remain there and convection could not take place in heating as it does in cooling from the top. Convection can only take place in heating by applying the heat at the bottom. If the water froze at the bottom we would have no fish, or in fact any life on this planet, as the large bodies of water have a great deal to do with life on earth.

There is one feature about melting ice that should be thoroughly understood, and that is the fact that if you take ice at a temperature of say zero, chop it up, take it into a room and let it melt, you will observe, if you place a thermometer in the ice and watch it, that it will rise from zero or whatever it was at until it reaches the freezing point 0° C. or 32° F., and at this point the temperature will stop rising, no matter what heat be around the vessel. This is why the freezing point of water is easily fixed, as it remains there at that temperature until all the ice is melted. Ice by itself behaves as solids do, expands by heat and contracts when cooled.

Ice will melt at a slightly different temperature if subjected to pressure, as shown by Thompson & Helmholtz, but it is only the fraction of a degree, so it does not affect any operation that we are connected with. In the upper provinces of India water is frozen on cold clear nights by putting it out in porous vessels, or in bottles wrapped in wet cloths. The water in these cases freezes by virtue of the cold produced by its own evaporation (or by the drying of the moistened wrapper). In Bengal the natives have a more elaborate scheme for forcing or aiding the natural conditions—pits are dug about two feet deep and filled three-quarters full of dry straw, on which are set flat porous pans containing the water to be frozen. Exposed to a cool dry gentle wind, the water evaporates at the expense of its own heat and cooling takes place with sufficient rapidity to overbalance the influx of heat from above through the cool dry air, or from below through the dry non-conducting straw. These are only aids to nature, and in this country where we can store ice they are unnecessary. Freezing mixtures, such as the familiar salt and snow, sulphate or phosphate of sodium, and dilute nitric acid, have been used to produce an intense cold, but I will pass over these, as they have no relation to this article or to practical refrigeration to-day.

The demand for ice for domestic, medicinal and other purposes has led not only to the development of an organized ice trade, but to the invention of machines for ice-making and for the more economical refrigeration of rooms or buildings than can be done with ice no matter how cheap it can be obtained. These machines are of the greatest value to countries where there is no natural supply of ice, but they have advantages over ice in the cooling of rooms for storage that are of as great benefit as the cooling effect itself. All ice machines of any practical value can be grouped under two heads, viz., those that utilize the lowering of temperature that follows the rapid expansion of a compressed gas, and those that make use of a like cooling effect that results from the volatilization of some liquid. In machines of the first type the gas usually employed is atmospheric air, which is first compressed to three or four atmospheres, and then cooled by circulating water or other means. It is then allowed to expand, and the heat necessarily absorbed during expansion is drawn either from the water to be frozen or from brine that does not freeze at ordinary freezing temperature and thus becomes a vehicle for storing or conveying the cold, so to speak. In 1849 Gorrie constructed such a machine, but it was unsatisfactory, principally because of not cooling and drying the air properly. Kirk's machine, patented in 1863, and Windhaussen's in 1870, were more efficient. Windhaussen exhibited one at Vienna Exposition that produced 30 cwts. of ice per H. P. at a cost of 20 cents per cwt. The mode of operation of this machine is as follows: The air is compressed in one end of a cylinder, then cooled, passes to the other end of the cylinder, and is admitted for a portion of the stroke; the supply then being cut off and the air expanded during the rest of the stroke; this reduces it to a low temperature. Part of this cold air is used for cooling purposes, and another portion of it is used for cooling the heated air after expansion. The air that passed to the refrigerrtor is forced on by more air coming in; and after passing over the course is forced back to the compressor side of the piston, still comparatively cool, where it is again compressed, cooled, expanded, and the circulation kept up continually. Such machines to work economically must have large cylinders with tight fitting pistons working with little friction, easy and perfect working valves. These conditions are a most impossible to obtain or maintain, consequently they are almost a failure. Another of this kind of machine was invented in Glasgow, using as the cooling agent the gas distilled from carbonaceus shale. The gas was compressed to 120 lbs., and after cooling and expanding was carried off and used as fuel. This machine is not used for the production of ice but for refrigeration, and has been used successfully on board ship (recompressing the gas, of course) for preserving meats, etc.

Among the machines of the second class there is a great variety of construction because of the difference in the property of the liquids used, viz., water, sulphuric ether, bi-sulphate of carbon, ammonia, methylic ether, sulphuric acid, and even other substances have been employed as refrigerating agents. In all cases it is the latent heat of vaporization that is utilized, and did the efficiency of the method depend only on this, water would undoubtedly be the best material on account of the great latent heat of its vapor; but as important as this is the pressure and temperature at which the liquid boils. As early as 1755 Dr. Cullen froze water by its own evaporation in a vacuum. This method was developed by others, but can only be used for producing small quantities of ice and has no practical value. The same objection applies to sulphuric ether, bi-sulphate of carbon or any substance which boils under ordinary atmospheric pressure at temperatures above the air. Ether boils at 34.8° C., bi-sulphate of carbon at 46.2° C., and their vapor pressures are respectively .377 and .267 of an atmosphere. They volatize more readily than water and require a comparatively slight vacuum to render their evaporation sufficiently rapid for refrigerating purposes. Naphtha, gasolene and chymogene have been used in place of ether, but ether is the best, while having the objection that it is hard to prevent leakage, consequently it is hard to maintain a vacuum. It has also the tendency to change itself into less volatile vapors. The great characteristic of ice machines that employ ammonia, methylic, ether or sulphuric acid, as compared with those of the ether type, is the fact that they work at increased instead of diminished pressures, since these substances are gaseous at ordinary temperatures and pressures, and require for the liquefaction either the production of low temperatures or the application of high pressures. I might just state here that the boiling point of ammonia is 38.5° C., its vapor pressure as taken from a table at 10° is 6.1 atmospheres, at 20 8.5 atmospheres, and at 30 11.6 atmospheres. The boiling point of methylic ethers is 23.65° C., and its pressure in atmospheres at the same temperatures as given for ammonia is 3.5, 4.8 and 6.5. Sulphuric acid boils at 10.68° C., and its pressure in atmospheres is 2.3, 3.2 and 4.5 at the respective temperatures of 10°, 20° and 30. You can see by these figures at once the reason or cause of the refrigerating action of these liquids?

The ammonia machine is the best known in this city, and, in fact, many do not know that there are other agents that can be used in place of ammonia. I will now try to make the action of mechanical refrigeration plain to you. We know that if we heat a liquid until it evaporates, it will absorb a quantity of heat that is not accounted for by the thermometer; that is, latent heat. We know if we suddenly reduce the pressure on boiling water that is under high pressure it will turn into steam. This latent heat evaporates it. Now, if we can get a liquid at low temperature that will evaporate into a gas at ordinary temperature, all we have to do is to compress it. That will give it a pressure, thereby increasing the boiling point; then if we cool this by the application of water we have a liquid at a lower temperature than is due to its pressure. If we now reduce the pressure we will reduce the temperature at which the liquid will boil, consequently it will boil on the reduction of pressure. Now, to boil, it must have heat just as water has, but as no heat is applied it must take up heat from surrounding objects. This is mechanical refrigeration. In the ammonia machine the gas is compressed thereby, raising its pressure and temperature. This gas passes from the compressor to a set of pipes over which cold water is running; this cools the gas and liquefies it or a portion of it. If it is then allowed to expand from high pressure to a low pressure, it will in expanding evaporate, and in evaporating it will take up heat from whatever surrounds the pipes containing it, that is, the air, thereby cooling the room. If the pipes are surrounded by water it will freeze; if by brine it will cool it down, and this brine can be pumped to any part of the building where it is not suitable or safe to use direct expansion of ammonia for cooling, and the brine will do the cooling instead. After the ammonia has expanded and evaporated to a gas it is returned to the compressor carrying the heat it picked up during expansion, and the compressor squeezes the heat out of it, so to speak, or makes it show, and it goes on through this cycle continuously. This system is known as the compression system, and the cycle of compression, condensation and expansion as explained before embodies the whole principle.

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*Abstract of a paper read before Toronto No. 1 C. A. S. E.

There is another system, known as the absorption system. This system I will not go into to-night. I have tried to make these few remarks as simple as possible, and to use no technical terms other than what anyone can understand. I have not touched on the application of refrigerating, which would take up a paper in itself.

BOILER FEED WATER.*

By J. M. Williams.

This subject, one especially interesting and very important to all users of steam plants, will be treated under four heads : Water in the abstract ; Water as we find it ; Water for the boiler; Water in the boiler.

At the commencement of this survey of the subject in hand, among the items to be borne in mind is the axiom "matter is indestructible." It will appear later on how this idea applies to the subject. Illustrating this, your attention is directed to what occurs when a match is struck, the friction rubs off the coating which protects the phosphorus with which the sulphur is tipped and warms the phosphorus up to the igniting point ; it bursts into flame and ignites the sulphur ; it in turn sets fire to the wooden splint, and it, as you see, burns first to charcoal, and it in turn to ash. None of the material or the elements of the material are annihilated—they are still in the room and in their altered form and condition will form part of the atmosphere. Some will condense on the objects or walls of this room, some will be inhaled by us and be absorbed into our system or condensed on our clothes and be carried away with us, but not destroyed, not annihilated, only separated from the combination in which they existed as a perfect match and recombined as a trace of phosphorus acid, a trace of sulphuric acid and the same of carbonic acid, gases, and a little ash containing the silica, potash lime, etc.; we thus have all the material that formed the match, every atom still exists.

Water in the Abstract.—Water, the familiar fluid, is a chemical combination of two gases, hydrogen and oxygen ; it may be made from these two gases and it may be resolved again into its original elements. This may be done by electric force or chemical action or by heat. These dissimilar disintegrating forces will make and unmake water. The apparatus which is used to illustrate the electrical decomposition of water will demonstrate the proportion of its two elements ; two glass tubes filled with water and inverted over two terminals from a battery will be slowly filled with gas displacing the water and one tube will be found to have twice the volume of gas of the other. This larger quantity will be found to be hydrogen, and this proportion will be maintained as long as the decomposition lasts ; this proportion is that of volume. Two volumes of hydrogen combine with one volume of oxygen. The weight of these volumes is in the ratio of two to sixteen, and each unitor atom of oxygen weighs sixteen times as much as one unit or atom of hydrogen. In the chemical decomposition of water, such as the familiar one of forming acetylene gas from carbide of calcuim, the oxygen is taken up by the metallic element and the hydrogen set free, also in the case of adding water to metallic sodium or potassium.

Water as we find it.—This would naturally suggest the large reservoirs of the earth, oceans, seas, lakes, rivers, etc., and the supplies in the form of snow and rain. These different supplies of water vary between the two extremes of pure and heavily charged with salt. Some lake waters are chemically pure, and the extreme is reached in the Dead Sea, where we find the water simply loaded with salt. Water is recognized as the universal solvent—it will dissolve to a greater or less extent nearly everything. The familiarity of this calls for little illustration, but it may be mentioned that solids, liquids and gases are dissolved by it. One example will be well recognized in the case of dissolved gas, that of soda water.

Water for the Boiler brings us to the particular features of the water supplies above mentioned. It will be accepted that water for the boiler should be clean, it also should be free from avoidable contaminations of injurious nature. The water supply will be of such a quality as the composition of the soil and the nature of the deposits in the locality, and any chemical refuse must be prevented if possible from getting into the supply. It will be found that in some cases the soil yields much matter to the stream flowing over it, and it occurs that water contaminated in one locality will be freed from its dissolved material by passing through a locality having a different composition of soil. In iron districts water will often be found freed from those elements which are destructive to boilers, the metallic deposits having taken up those elements. Some of the substances which are thus found in water supplies are there because of the decomposition of the material forming the water course by the action of the water itself ; in other cases it occurs that the district is of volcanic origin, or it may be the remains of ancient ocean beds, or the accumulations of large deposits of organic matter, bogs, marshes, etc. We may here consider the nature of the substances which we find in water supplies. The usual ones are chlorides, sulphates, carbonates and nitrates, the elements so combined being calcium lime, magnesium, sodium, potassium, ammonium. Metallic compounds also in particular localities will include some of the heavy metals, such as lead, copper, etc. These, like the above, are carriers of injurious elements and are not dangerous excepting from forming deposits in the boiler. Another form in which water receives substances which may have bad effects is in gaseous condition in the air ; from this source ammonia will carry into water chlorine and sulphur. Carbonic acid gas and even free nitric acid are substances which are features of the atmosphere, and to a greater or less extent injurious constituents of a water supply.

Referring to volcanic deposits having a tendency to affect the water in their neighborhood, it may be mentioned that so acid are some streams from the sulphuric acid formed from the sulphur that the copper sheeting of vessels is cleaned of oxide and the copper made bright by the solvent action of the acid in the water, and in certain rivers of this continent it is estimated that thousands of tons of sulphuric acid pass annually into the sea, and it is noted as a fact that in the civil war in America, the telegraph batteries of certain localities depended on vitriolic streams for their acid.

Water in the Boiler.—This part of the subject brings altered conditions. Water in its ordinary state has a temperature of about 40 to 50 degrees F., and the solvent quantity differs according to temperature. In many instances water will dissolve more when hot than cold, but conversely the earthy salts usually formed in water supplies are precipitated mainly because these salts are held in solution by carbonic acid gas, and this with other gases is much more soluble in cold water than warm, and is dissipated from hot water, with the result of the throwing out of solution of the earthy salt. This, together with the evaporation of water leaving the solids behind in making stream, is the cause of scale and boiler mud.

Not only is the mud left behind, but the elements which form the chlorides, sulphates, etc., remain also, and these, under the influence of the high temperature in the presence of moisture, decompose with the liberation of the radicle or acid part of the substance, which is then free to act on the iron plates or tubes, which it does to the sorrow of many a boiler owner. It will be recalled that the permanency of water was referred to at the beginning of this paper. We here meet with the system which operates when matter is subjected to altered conditions, if the alteration is considerable, to the extent which we have observed to occur in the boiler; then the combinations which previously existed will be broken up and other combinations will occur—calling to mind the match—and the metal of the boiler is called on to take its part in forming these combinations. A water containing chlorides is fed into a boiler and concentrated by the loss by evaporation into steam of the water. This concentration brings with it the breaking up of the chlorides. Carbonic acid gas being present, free and also combined, is liberated by the decomposing effect of high temperature as referred to already, and by that law which governs matter and which couples atoms, to themselves if nothing else is available; this carbonic acid gas displaces the chlorine combined as chlorides, and this in turn seeking to obey this law of combination, unites itself to its heat affinity, the iron of the boiler plate.

It will here be concluded that the chlorine having done its best or worst is out of the game, but no, chloride of iron is not more stable than chloride of calcium, magnesium, potassium, sodium or any chlorides which may pass into the boiler in the feed water. Chloride of iron will take up oxygen, which as atmospheric air is taken into the boiler, dissolved in the water, and if this were not there the water would be called on to furnish oxygen and an oxychloride formed passing on into a further addition of oxygen, and the formation of an insoluble oxide of iron and the chlorine is again on its cruel mission after an atom of iron, and so goes on moment after moment to a misroscopical extent, it is true, but like the coral insect, a little at a time if carried on long enough will accomplish much. As with the chlorine, so with the other salts ; just the exact changes and processes it is not presumed to define, but the foregoing will throw light on the cause of the corrosion of boilers. Having surveyed to a limited extent the origin of scale and the cause of corrosion, we will consider the action of boiler purges. We have observed the liberation of corrosive acid elements, and to neutalize these most purges are alkalies, and remembering the decompositions just referred to, we can see that if these neutralized acids now in the form of salt, generally a soda, are allowed to remain in the boiler, we can expect to experience similar results again, calling apparently for more alkali, but the precautions which will best combat these dangers are emptying the the boiler, washing out and filling with fresh water. This has its limit, however, and must of necessity be controlled by fuel, time and circumstances, but it can be seen how valuable is blowing off—which only deducts from the contents of corrosive matter in the ratio of what is blown off—and more especially cleaning out.

[Two samples of boiler feed water were shown, one from a supply tank which showed presence of sulphuric acid and which had been complained of as being continually corroding. The other sample showed chlorides, both samples indicated by tests presence of free acids. The action of phosphate purge was also illustrated in conjunction with lime and magnesia, showing precipitation of the same.]

At the regular meeting of Toronto No. 1, Canadian Association of Stationary Engineers, held on the second Wednesday in January, there was a good attendance of members. A paper relating to ice making and refrigerating machines was read by Mr. E. J. Philip, chief engineer of the T. Eaton Co. This paper, which is printed in this issue, created considerable discussion, and many questions were asked and explained. It has been arranged to hold an "At Home" in the large assembly hall of the Confederation Life Building on Wednesday, February 14th. The tickets are $1.

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*Paper by J. W. Williams, of J. Winer & Co., chemists, Hamilton, read before Hamilton No. 2, C.A.S.E.

ELECTRIC RAILWAY DEPARTMENT.

CANADIAN STREET RAILWAY SYSTEMS.

During the past month several of the largest street railway companies in Canada have held their annual meetings. The statements presented, as outlined below, show that generally the business of the year was of satisfactory character.

HAMILTON, GRIMSBY & BEAMSVILLE ELECTRIC RAILWAY.

The annual meeting of the shareholders of the Hamilton, Grimsby & Beamsville Electric Railway Company was held in the city of Hamilton on January 22nd. Mr. A.J. Nelles, manager and secretary, submitted the financial statement, which was evidently satisfactory, there having been an increase of $1,934.33 in the revenue over that of 1898. The revenue for 1899 was $44,670.75, and the disbursements amounted to $27,729.87, leaving $16,940.88 of a surplus. Of the surplus $4,250 was paid in interest on bonds, $2,152.24 interest on borrowed money, and $5,665 as dividends, quarterly at 1 1-4 per cent.; total, $12,067.24. The balance, $4,873.64, added to $2,950.11 brought forward from 1898, made a total surplus of $7,823.75. The assets were given as $277,474.38. The liabilities were :—To the public $128,702.21, to the shareholders $113,300 capital stock, and $35,472.17 profit and loss account. A by-law was passed for the issuance of $35,472.17 of stock to paid-up shareholders, pro rata, this being 33 1-3 per cent. of the capital stock, $113,300. Officers and directors were elected as follows: C. J. Myles, president; W.J. Harris, vice-president; R.S. Martin, treasurer; L. Bauer, A.H. Myles, Robert Ramsay, R.S. Morris, directors. Mr. Morris was elected in place of John Gage, sen., who retired. Mr. A. J. Nelles was re-appointed manager and secretary.

LONDON STREET RAILWAY.

The twenty-fifth annual meeting of the London Street Railway Company was held at the company's offices in London. The annual report, which was read by Mr. C.E.A. Carr, secretary treasurer, showed a falling off in gross revenue, as compared with the previous year, of $53,864.19, and the working expenses exceeded the receipts by $6,928.54. This was due to a strike of employees which commenced on May 22nd and continued for several months. The gross revenue for the year was $59,947.58, as against $113,811.75 for the previous year. The operating expenses were $66,872.10, an increase over the previous year of 1.8 per cent. The quarterly earning statement showed that the revenue increased during the first quarter of the year, when there was no strike, 10.2 per cent., so that had the system remained in operation without interruption a most satisfactory year would likely have been the result.

The old board of directors was re-elected: Mr. Everett, president; Mr. Smallman, vice-president; Mr. Carr, general manager and secretary-treasurer, and Messrs. Moore, Wasson, Spencer and Broderick, directors.

OTTAWA ELECTRIC STREET RAILWAY.

The Ottawa Electric Railway Co. experienced the most successful year in its business history. The statement presented at the annual meeting showed that the total number of passengers carried was 5,833,829, an increase of 700,000 over the previous year. The net profit was $85,280.37. Four quarterly dividends were paid, amounting to $65,184, and the sum of $20,093.37 was carried forward to the credit of profit and loss. The gross earnings for the year were $263,545.05, as compared with $231,806.02 in the preceding year. A duplicate plant was installed during the year, consisting of a set of horizontal water wheels of a capacity of 1,800 h.p., directly connected to a generator of similar capacity. The Britannia extension is expected to be in operation by May 1st.

The following were elected directors: Messrs. T. Ahearn, J. W. McRae, George P. Brophy, Warren Y. Soper, Peter Whelan, Thomas Workman and Alex. Lumsden, M.P.P. At a subsequent meeting of the board Mr. Thos. Ahearn was elected president, Mr. J. W. McRae vice-president, and Mr. James D. Fraser, secretary-treasurer. Mr. Redmond Quain was appointed auditor.

TORONTO STREET RAILWAY.

The eighth annual meeting of the Toronto Street Railway Co. was held on Wednesday, January 17th. The report of the year showed a net profit of $432,869.43, compared with $404,738.80 for the previous year. Out of this amount, after paying dividends of $240,000, and deducting pavement charges paid to the city, the sum of $12,869.43 is left to carry forward. The gross earnings during the year were $1,333,542.44, an increase of $122,924.20 over the preceding year.

The operating expenses were increased by 1.4 per cent as compared with those of 1898, this being ascribed chiefly to a general advance in the cost of materials. A capital expenditure of $240,000 was made for an engine, generator, boiler, rolling stock, feed wires and car sheds. During the year 80 cars and two electric sweepers were added to the rolling stock. Two car sheds, capable of storing 100 cars, and a brass foundry were built.

During the year the company paid to the city the following amounts: Percentage on earnings, $111,425.66; pavement charges, $64,000; taxes on rails, poles and wires, $2,641.12 and on real estate $$9,365.85, or a total of $187,432.63. In addition there was also paid the provincial tax, amounting to $4,748.21.

As shown by the financial statement, the assets of the company total $10,263,615.27, made up as follows: Road and equipment, real estate and buildings, including pavements and suburban lines, $10,080,053.01; stores in hand, $30,874.87; accounts receivable, $19,764.63; cash in bank, $106,210.84, and cash in hand, $16,811.92. The liabilities are: Capital, $6,000,000; bonds already issued, $2,999,953.33; and incidentals, which, with nearly $1,000,000 carried to profit and loss, bring the total to $10,263,615.27.

A comparative statement of the last four years is as follows:

Gross earnings—1896, $997,273.20; 1897, $1,077,612.53; 1898, $1,210,618.24; 1899, $1,333,542.44.

Operating expenses—1896, $507,760.31; 1897, $525,801.25; 1898, $578,857.26; 1899, $650,324.55.

Net earnings—1896, $489,512.67; 1897, $551,811.28; 1898, $631,760.98; 1899, $683,217.89.

Passengers carried—1896, 23,537,911; 1897, 25,271,314; 1898, 28,710,388; 1899, 31,826,040.

Transfers—1896, 7,354,805; 1897, 8,160,022; 1898, 8,287,239; 1899, 10,538,270.

Percentage of operating expenses to earnings—1896, 50.9; 1897, 48.8; 1898, 47.4; 1899, 48.8.

SPARKS.

An agitation has been commenced to have the village of Granton, Ont., lighted by electricity from the power house in the village of Lucan.

The St. Catharines Cold Storage Co., Ltd., have ordered a 20 horse power 500 volt multipolar motor from the Canadian General Electric Company.

Residents of Crediton, Ont., are said to be looking into the question of profitable investment in an electric light plant for street and commercial purposes.

The Canadian General Electric Company are installing several of their two phase induction motors at the works of the Hamilton Bridge Works, Hamilton, Ont.

The Slade Electric Company, of Quebec, has secured the contract for electric wiring of the Franciscan church, sacristy and presbytery on Grande Allee, in Quebec city. Nearly 1,000 lights will be required.

The authorities of Winnipeg general hospital are installing an electric lighting plant, and have placed an order with the Canadian General Electric Company for one of their standard direct current 60 kilowatt generators of the multipolar type.

Application will be made to the Dominion Parliament for an act to permit the Buffalo Railway Co. to acquire the assets and franchise of the Niagara Falls Park & River Railway Co., the Clifton Suspension Bridge Co., the Queenston Heights Suspension Bridge Co., and the Queenston Heights Bridge Co.

The Pratt & Letchworth Co., of Buffalo, who are about to open a Canadian factory for the manufacture of steel castings, etc., at Brantford, Ont., have placed their order for electrical equipment with the Royal Electric Co. This order includes one 40 h.p. and two 15 h.p. S.K.C. induction motors, with transformers and condensers.

Mr. F. B. Brothers, well known in street railway circles, returned to Montreal from Demarara last month. Mr. Brothers is now manager of the Demarara Electric Co., Limited, and his mission is to purchase equipment for the trolley system to be built at Georgetown, British West Indies, by Montreal capitalists. He states that about 15 miles of track will be laid down in the city and that considerable extensions will be made later on.

The South African Mutual Life Insurance Co., of Port Elizabeth, Cape Colony, has awarded the contract for a complete electric light plant to the Royal Electric Co., of Montreal, Canada. This plant consists of two 50 h.p. locomotive boilers two 8 x 10 high speed engines, direct connected to two 22½ k.w. direct current generators, a marble switchboard and a set of storage batteries, the whole to be installed in the South African Mutual Life Insurance Co.'s new premises at Port Elizabeth.

The shareholders of the Toronto & Suburban Railway Co. held their last annual meeting at Toronto Junction on January 24th, at which the following directors were elected: Frank Turner, C.E., R. Wilson Smith, Robert B. Henderson, Allan Boyce, sr., E. P. Heaton and R. L. McCormack. At a subsequent meeting of the directors, Frank Turner was elected president and E. P. Heaton vice-president. It was decided to look into the advisability of extending the road further into the county.

The third annual session of the International Mining Congress will assemble in the city of Milwaukee, Wis., on Thursday, June 19th, 1900, and continue for five days. It is expected that this congress will be of great importance in promoting the interests of the mining industry. Large committees have been appointed, and visitors will be given every attention. Information regarding the congress will be cheerfully furnished by Mr. T. J. Sullivan, secretary of the local executive committee, Sentinel Building, Milwaukee.

The annual meetings of the Hamilton Radial Railway, Hamilton Street Railway, and Hamilton and Dundas Railway, three corporations controlled by the Cataract Power Company, were held on January 15th, when the following officers were elected: Radial Railway Company—John Patterson, president; Hon. J. M. Gibson, vice-president; J. Moodie, treasurer. Hamilton Street Railway Company—Hon. J. M. Gibson, president; John Dickenson, vice-president; John Patterson, secretary; John Moodie, treasurer. Hamilton and Dundas Railway Company—John Dickenson, president; J. A. Kammerer, vice-president; J. Patterson, secretary; John Moodie, treasurer.

At 11 o'clock on the night of Tuesday, January 9th, fire occurred in the power house of the St. Jerome Light & Power Co., St. Jerome Que., which totally destroyed their electric plant. On Wednesday afternoon at 3 o'clock the Royal Electric Co. was instructed by the St. Jerome Company to forward to them, as quickly as possible, a 75 k.w. S.K.C. generator, complete with exciter and switchboard. The entire outfit went forward that evening, was received in St. Jerome Thursday morning at 10 o'clock, the destroyed plant was removed, and the new one put in its place and the lights turned on as usual at 5 p.m. on Friday. Forty-eight hours after the receipt of the order by the Royal Electric Co. in Montreal lights were again burning in St. Jerome. This is quick work, and shows what can be accomplished by thoroughly wide-awake people.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 5.40	A.M. 6.15	12.35
2....	" 7.00	" 6.15	11.15
3....	" 8.00	" 6.15	10.15
4....	" 9.20	" 6.15	8.55
5....	" 10.30	" 6.10	7.40
6....	" 11.30	" 6.10	6.40
8....	A.M. 12.30	" 6.10	5.40
9....	" 1.30	" 6.10	4.40
10....	" 3.00	" 6.00	3.00
11....	" 3.30	" 6.00	2.30
12....	No Light.	No Light.	.....
13....	No Light.	No Light.	.....
14....	No Light.	No Light.	.....
15....	P.M. 6.00	P.M. 8.30	2.30
16....	" 6.00	" 9.30	3.30
17 ...	" 6.00	" 10.30	4.30
18....	" 6.00	" 11.20	5.20
19....	" 6.00	A.M. 12.00	6.00
20....	" 6.00	" 1.00	7.00
21....	" 6.10	" 2.00	7.50
22....	" 6.10	" 3.00	8.50
23....	" 6.10	" 4.00	9.50
24....	" 6.10	" 5.00	10.50
25....	" 6.10	" 5.40	11.30
26....	" 6.10	" 5.40	11.30
27....	" 6.20	" 5.40	11.20
28....	" 6.20	" 5.40	11.20
		Total.........	185.00

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Complete Circuit Series
Lamps with Regulator—.90.

Manhattan Regulating Reactance Coil.

Regulator loss constant at all loads, 200 watts.
Regulators to provide for any percentage of circuit, from 10 to 100 per cent.

Manhattan Series A. C. Enclosed Lamps.

At 6.6 amp., 72-volts, 430 watts. Total loss in lamp, 5 watts.
Power Factor .91. Efficiency .99.
Terminal and Arc Voltage the same. Concentric mechanism, but one magnet used in lamp. No springs.

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TRADE NOTES.

The Goldie & McCulloch Co., Limited, Galt, Ont., recently supplied a boiler for the Hamilton Steel & Iron Co., Hamilton.

Walter E. H. Massey has purchased from the United Electric Co., Toronto, a motor for operating fans at his Model farm.

Messrs. Lawry & Sons, pork packers, Hamilton, Ont., have added to their electrical equipment a 7 h.p. S.K.C. induction motor, purchased from the Royal Electric Co.

We are indebted to the National Carbon Co., of Cleveland, Ohio, for copies of their calendar for 1900, accompanying which is the moonlight schedule for the year.

At a meeting of belting manufacturers and dealers held in Montreal a fortnight ago an advance in prices was decided upon, due to the advanced cost of the raw material.

The Canadian General Electric Co. have received an order from the corporation of the town of Drummondville, P.Q., for one of their standard 45 kilowatt 500 volt multipolar generators.

The Toronto & Hamilton Electric Co., of Hamilton Ont., have recently removed to larger premises, in which they have installed considerable new machinery, which is driven by electricity.

The Calgary Water Power Co., of Calgary, N.W.T., has been compelled to increase its plant, and is installing a 150 k.w. S.K.C. two-phase inductor alternator, supplied by the Royal Electric Co., of Montreal.

The Gutta Percha Rubber Co. of Toronto are increasing their electric lighting plant, and have ordered another 50 kilowatt generator, direct connected to an Ideal engine, from the Canadian General Electric Company.

Messrs. Ahearn & Soper, of Ottawa, Canadian agents of the Westinghouse Electrical and Manufacturing Co., are sending out a very neat paper knife, which will be appreciated for its usefulness and serve well the purpose of an advertisement.

The attention of the electrical companies is directed to the advertisement of Mr. E. J. Brown, of Brantford, on the last page of cover of this number, in which he intimates that he is in a position to make repairs to all kinds of electrical apparatus on short notice.

The National Cycle & Automobile Co., who have recently commenced the manufacture of bicycles, automobiles, etc., in the city of Hamilton, intend operating their works by electricity, and have placed their order with the Royal Electric Co., of Montreal, for two 30 h.p. S.K.C. induction motors.

Messrs Collyer & Brock, electrical engineers and contractors, Montreal, are now engaged in installing 350 incandescent lights and 18 telephones in the residence of Hon. G. T. Fulford at Brockville, Ont. They have also been awarded the contract for fitting up electrically the Eastern Townships Bank at St. Hyacinthe, Que.

The Canadian General Electric Company have received an order from the Trenton Electric Company for one of their standard three-phase alternators, 250 kilowatt capacity, wound for 2,300 volts, together with switchboard, step up and step down transformers and distributing panels, for their sub-station at Belleville, Ont.

The gyrator system of flour milling, of which the Goldie & McCullough Co., Limited, Galt, Ont., are the sole Canadian makers, is meeting with much favor among millers. They have put this machinery in mills in nearly every province in the Dominion. Recently a car-load was shipped to the Farmers' Milling Co., Fort Saskatchewan, N.W.T.

The town council of Neepawa, Manitoba, in accepting the electric light and power plant recently installed by the Robb Engineering Co., passed the following resolution: "That this council have much pleasure in bearing testimony to the efficient manner in which J. F. Porter has installed the engine and boilers in connection with our electric plant, and that a copy of this resolution be sent to the Robb Engineering Co."

A completely equipped electrical supply house is that of Mr. John Forman, of Montreal, whose new quarters are at 708 and 10 Craig street. The building is four stories high, beside the basement, and is admirably lighted and fitted up. In the basement is found the heavy goods, such as cables, conduits, heavy wires, insulators, etc. Mr. Forman's private office is located on the second floor, together with a new laboratory equipped with various instruments for testing incandescent lamps. In this laboratory instruments may be tested by the public free of charge, a privilege which will no doubt be appreciated by users of electricity. The two upper stories will be devoted to manufacturing. Mr. Forman has purchased the plant of the Canadian Bryan Electric Co., and will manufacture a complete line of cut-outs, switches, rosettes, sockets, etc.

An ingenious arrangement to prevent overcrowding of stairways and elevators when entering or leaving a building is used in main office of the International Correspondence Schools, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly, but on the upper floors they are a few minutes slow, so that the employees on the lower floors are at their desks before those on the upper floors are due at the building. In leaving the building the employees on the upper floors do not leave their desks until several minutes later than those on the lower floors. Over 500 people are employed in the building, which is used exclusively by the International Correspondence Schools. This institution has over 70 courses of instruction by mail and its students may be found in all parts of the world.

The United Electric Company, Toronto, report the following sales: The Tate Optical Co., Peterboro, a motor for operating their plant; Ritchie & Ramsey, New Toronto, a dynamo for lighting their works; Dodge Mfg. Co., Toronto Junction, Ont., dynamo for lighting their works; Hamilton Steamboat Co., dynamo for lighting the steamship Macassa; The E. S. Stephenson Co., St. John, N.B., several motors, among others two of 8 h.p., two of 6 h.p., and one of 2 h.p.; F. B. Allan, of Toronto, for the Nonsuch Mfg. Co., a 15 h.p. motor with which they intend to operate their manufacturing plant; Jas. Fenwick, Preston, a 75 light arc dynamo, with a number of lamps, for lighting the town of Preston; J. Forman, Montreal, a number of their standard type motors, including one of 6 h.p., and one of 8 h.p.; H. Phillips, Toronto, one of their 6 h.p. standard type motors for operating his manufacturing plant. The United Electric Company have also just completed an installation for lighting the factories and yards of the Northumberland Paper & Electric Co., of Campbellford, Ont.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED THOMSON & CO.
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have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. Telephone Main 3149.

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That there are more **Victor Turbines** in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.

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High Speed, Close Regulation, Great Capacity
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RECENT PLANTS INSTALLED:—Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Cataract Power Co., Hamilton, Ont.

CORRESPONDENCE SOLICITED.

The Stilwell-Bierce & Smith-Vaile Co. = DAYTON, OHIO. U. S. A

SPARKS.

A committee has been appointed by the Ottawa city council to investigate the civic lighting plant question.

The Scotstown Mills Co., of Sherbrooke, Que., has obtained a charter for lumbering, mining and electrical purposes.

The foundation for the power house of the Cascade Water Power & Light Co., at Cascade City, B.C., has been completed.

The town council of Welland, Ont., is negotiating with the Electric Light Company for a renewal of the street lighting contract.

It is rumored that the Cataract Power Co., of Hamilton, are considering the building of a power canal from the Chippewa creek to connect with their canal at Allanburg.

The Department of Railways and Canals of Canada have invited tenders for the construction of two non-condensing marine engines and a Clyde boiler for the St. Lawrence canals.

The town council of Woodstock, Ont., has authorized the Fire and Light Committee to obtain figures for the installation of an electric light plant and the introduction of an all-night service.

The Ingersoll Electric Light & Power Co., of Ingersoll, Ont., are installing an electric light plant in the condensing factory in that town. It is said that the company may install a power plant at an early date.

It is expected that the civic lighting plant at Winnipeg will be completed shortly. The electrical apparatus was furnished by the Westinghouse Co., of Pittsburg, and the boilers and engines by the Polson Iron Works Co., of Toronto.

Suit has been entered by James Ellicott against the Lachine Rapids Hydraulic & Land Co., of Montreal, for $5,000 damages for injuries received while in their employ by coming in contact with a live wire. Deficient insulation is alleged.

The Canadian Locomotive & Engine Co., of Kingston, Ont., have gone into voluntary liquidation, Mr. A. Riddell, of Montreal, having been appointed provisional liquidator. The company is understood to be fairly prosperous and to have large orders on hand.

The bright advertising man of an electric lighting company recently perpetrated the advertising bull of the season by announcing that his company was prepared to furnish a "matchless electric lighting service." The rest of the boys are now using the matches to light the cigars he buys for them.—Newspaper Maker.

The sulphuric acid for use in the Ottawa Electric Co.'s storage battery plant was procured in England, through Messrs. Evans & Sons, wholesale druggists, of Montreal. There were 5,000 pounds, which is said to be the largest quantity of that article that has ever been imported into Canada in one shipment.

The Brown Brothers Company, of Toronto, are removing to their new commodious warehouse on Wellington street west. They purpose operating their entire machinery by electricity, and have placed an order with the Canadian General Electric Company for a number of form H moderate speed motors.

A Moffatt feed water heater and oil extractor is being put in the Goldie Milling Co.'s mill at Highgate, Ont. These heaters are made by the Goldie & McCulloch Co., of Galt, Ont. Every engineer should send for a catalog of them, as they are meeting with great success.

The town council of Dartmouth, N.S., has decided to apply to the legislature for authority to borrow $40,000 to provide the town with an electric light plant. It is proposed to utilize the water power at Port Wallace locks, and an engineer will be engaged to report on the quantity available. Mr. Sieberts is the municipal electrician.

The Canadian General Electric Company have just received an order from the Toronto Electric Light Company for two 450 k.w. 250 volt direct current power generators and one 400 k. w. revolving field single phase 2400 volt alternator. These machines are to be used in the new power house of the company, to meet the ever increasing demand for light and power.

The annual meeting of the Brandon Electric Light Co. was held on January 18th, at which the question of securing cheaper power was discussed. As a result it is probable that steps will be taken to utilize the water power of the Little Saskatchewan river, which flows into the Assiniboine about eight miles west of Brandon. Mr. Geo. Patterson is manager of the company, and Judge Walker, of Winnipeg, is a member of the board of directors.

The Canadian Electric Light Company, of Levis, P.Q., are undertaking a very extensive electric power transmission scheme, and have placed their initial order for electrical apparatus with the Canadian General Electric Company. This order consists of two 750 kilowatt revolving field three phase alternators. These are to be wound for 10,500 volts, thus eliminating the necessity for step-up transformers. The Canadian General Electric Company are also furnishing the necessary exciters and marble switchboards.

Messrs. Lever Bros., Limited, of Port Sunlight, England, have awarded to the United Electric Company the contract for equipping their entire new works being built in Toronto, which will be known as the Sunlight Soap Works, with a complete electric plant for power and lighting. The plant will consist of generators direct connected to high speed automatic engines, and fifteen multipolar motors. The securing of this contract speaks well for the apparatus of the United Electric Company, as we understand it was obtained in competition with Canadian, American and English firms, and was awarded to them after a thorough investigation into the merits of the different types of apparatus.

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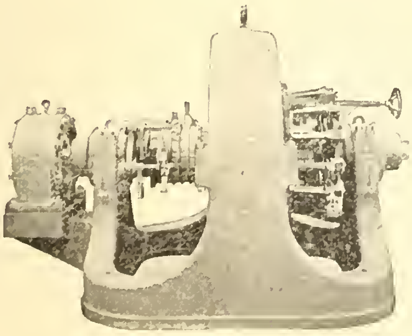

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SPARKS.

The Belleville electric street railway will be sold by public auction under mortgage on March 1st.

The ratepayers of Rat Portage, Ont., have voted in favor of the town purchasing the electric light plant.

The Truro Foundry & Machine Co., of Truro, N.S., contemplate installing an electric plant for lighting their works.

Davidson & Henderson, of Toronto, have purchased from the United Electric Co. a motor for operating their printing presses.

Mr. Geo. F. Macdonald, superintendent of the Ottawa fire alarm system, has recommended that at least ten more improved boxes be installed.

The Montreal Electric Company have placed an order with the Canadian General Electric Company for two marble feeder panels and instruments.

The Goldie & McCulloch Company, of Galt, Ont., recently shipped some heavy special machinery to the St. Charles Condensing Company, Ingersoll, Ont.

The Sherbrooke Gas & Water Co. are again compelled to increase the capacity of their plant, and during the coming summer will install an 8,000 light dynamo.

The Canadian Corundum Co. purpose erecting a crushing and concentrating mill on the Madawaska river north-east of Bancroft, power to be obtained from an adjacent water fall.

The lighting of the streets of Welland, Ont., is now receiving attention by the town council. Some of the members favor the purchase of the electric light plant by the corporation.

The city engineer of London, Ont., has estimated the cost of installing sufficient plant to use the surplus electric power at Victoria hospital to illuminate the city buildings at $4,700.

The Fire and Light Committee of Toronto Junction council have recommended that an electrical expert be engaged to report on the required alterations and improvements to the town's electric lighting plant.

The Underwriters' Association has recommended that the town of Barrie, Ont., install an electric fire alarm system. The council of that town is considering the extension of the electric lighting system to Allandale.

Mr. Edward Irving, electrican, of Hamilton, is understood to be preparing plans for St. Andrew's Falls Power Co., of Winnipeg. This company purposes developing 3,000 horse power from a fall 17 miles from Winnipeg.

Mr. W. T. Stewart, electrical engineer, of Toronto, estimates the cost of a civic electric light plant for Toronto at $250,000, and operating expenses at $78,020. At the present time, he says, the city pays $107,482.49 for electric lighting.

Messrs. Conroy Bros. are building a new power house at Deschenes, Que., they having entered into a contract to supply the E. B. Eddy Co., of Hull, with 2,000 horse power for a period of ten years. The price per horse power is reported to be $15.

John Gillis, an employee of the armature department of the Canadian General Electric Co., Peterboro, recently met with an accident by which 2,400 volts are said to have passed through him. Both arms were badly hurned and other injuries sustained.

The Renfrew Electric Light Co., Limited, of Renfrew, Ont., has been granted a provincial charter. M. A. A. Wright is president and manager, Mr. A. Hough vice-president, and Mr. Howard Wright secretery-treasurer. The capital of the company is $75,000.

The Midland Electric Co. are now negotiating with the town council for a renewal of their lighting contract. They have offered to supply arc lamps of 1,200 c.p. at $45 per year per lamp for service until 2 a.m., or $60 for an all night service on moonlight schedule.

The city engineer of Hull, Que., has prepared plans for for the dynamo station to be built in connection with the water works power house. The plans provide for 75 arc lights, covering about six miles of street and eight miles of wire. There will be two 50 light dynamos.

The eighth annual meeting of the shareholders of the Galt, Preston & Hespeler Street Railway Co. was held on February 1st. The statement presented showed that there were carried during the year 232,361 passengers and 15,515 tons of freight, making the total earnings $19,579.42. It is understood that the Cataract Power Co., of Hamilton, have secured a controlling interest in the road.

The Canada Atlantic Railway have lately placed new electric safety signals at the intersection of several streets in the city of Ottawa. As a train approaches, when 1,600 feet from the first crossing, and electrical connection is made. Immediately the light at the crossing lights up and the bell starts ringing vigorously. This keeps up till the train crosses the street, when the bell is cut off. This system of signalling is in vogue in the United States, but the Canada Atlantic Railway is said to be the first to introduce it in Canada.

In connection with the suggestion of our Montreal correspondent in last issue that the correspondence schools should so arrange their courses as to eliminate the dry mathematics and preliminaries and get right at lectricity, the International Correspondence Schools, of Scranton, Pa., have sent us a copy of their aplication blank, and point out that the method of instruction is graduated so as to suit the needs of each individual student. If a student is qualified to pass an examination in any subject, they state that he may be excused from doing work on that subject.

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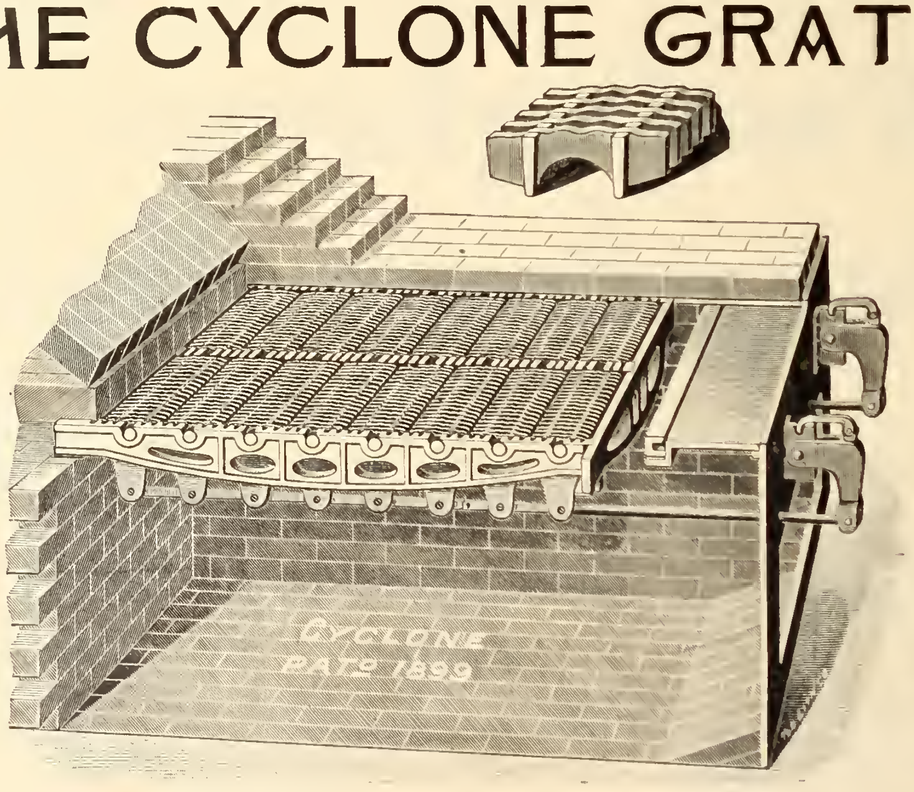

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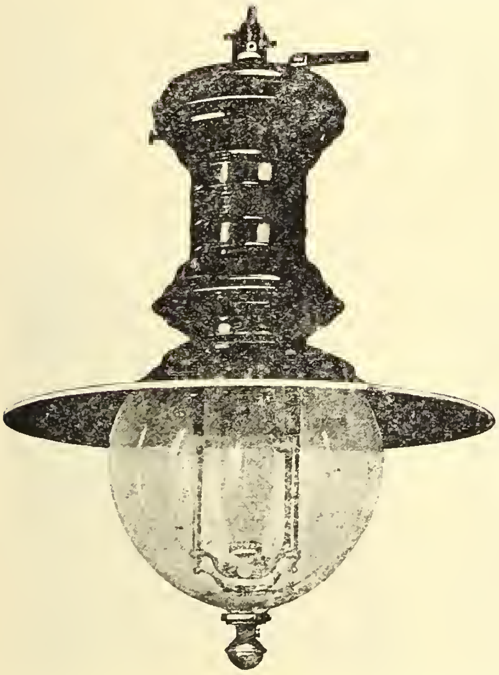

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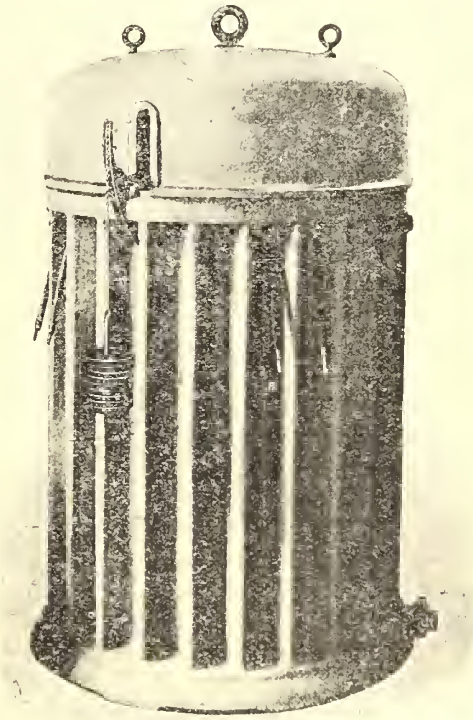

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SPARKS.

Mr. J. de Froment, of Rathwell, Man., has invented an electric fire alarm for which he claims many points of merit.

Mr. H.C. Symmes, a New York electrician, has joined at Guelph, Ont., the second Canadian contingent for service in South Africa.

At the municipal elections the ratepayers of Prescott, Ont., voted in favor of handing over the management of the electric light plant now operated by the town to the water commissioners.

The United Electric Co., of Toronto, have closed a contract with Messrs. Darling Bros., of Montreal, for motors to be used direct connected to elevators at the Longue Pointe Asylum near Montreal.

The Goldie & McCulloch Co., Limited, of Galt, Ont., have just shipped two of their Ideal high speed engines, one to Sarnia for the Canadian General Electric Company, and the other to the Montreal Rolling Mills Company, Montreal.

The Sandwich, Windsor & Amherstburg Railway Co. have purchased a 150 horse power gas engine from Westinghouse, Church, Kerr & Co., of Detroit. The engine will be used for operating their electric road and will replace a Corliss steam engine.

The Electric Light Committee of the city council of Victoria, B.C., will recommend the installation of an incandescent plant of 1,000 lights capacity for lighting the city hall and other civic buildings. The corporation now operates the arc plant for street lighting.

R.F. Prefontaine, Q.C., of Montreal, and associates, have applied for the incorporation of the Labrador Electric Light & Power Co., to acquire and develop for electrical purposes water powers on the Murray Bay River, and to operate electric railways in the districts of Charlevoix, Chicoutimi and Sagueney, in Quebec.

The Hoepfner Refining Company, of Hamilton, have placed an order with the Canadian General Electric Company for two 1500 ampere 120 volt generators, to be used for electrolytic purposes. These machines are to be direct connected with Stanley motors, and the power will be supplied by the Cataract Power Company, from their DeCew Falls transmission lines. The plant when completed will be one of the most interesting in Canada.

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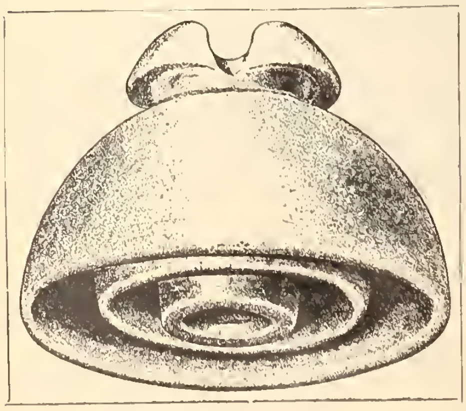

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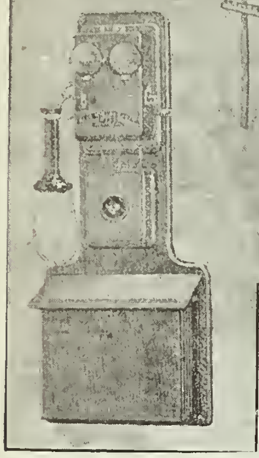

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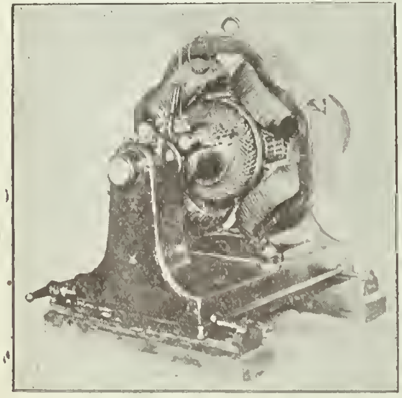

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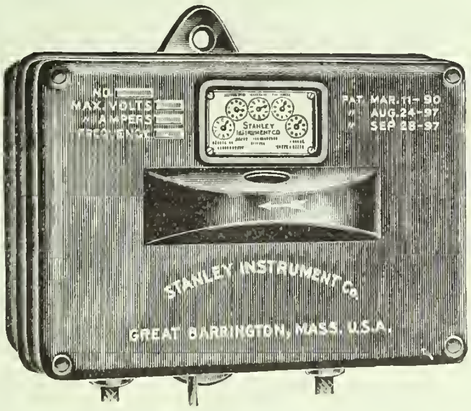

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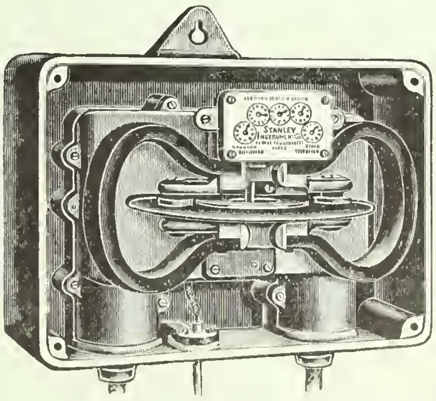

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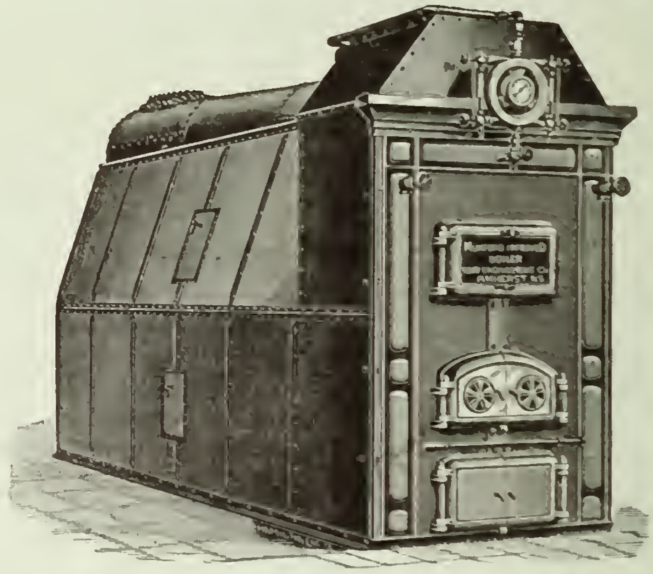

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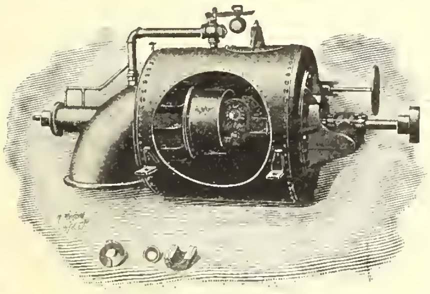

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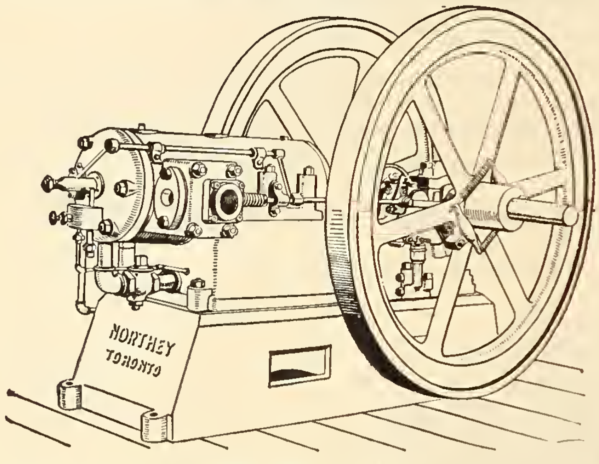

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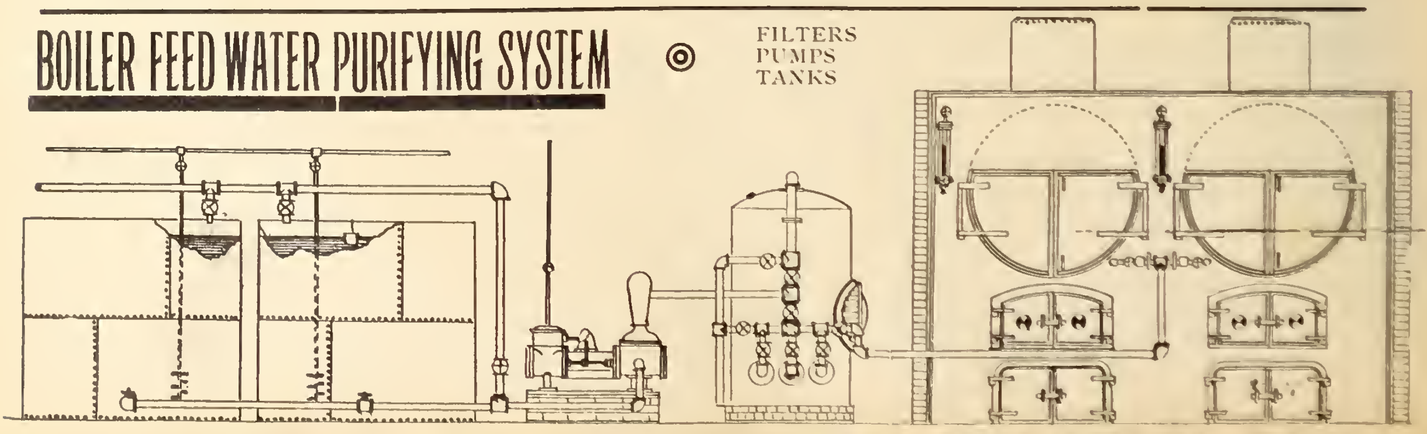

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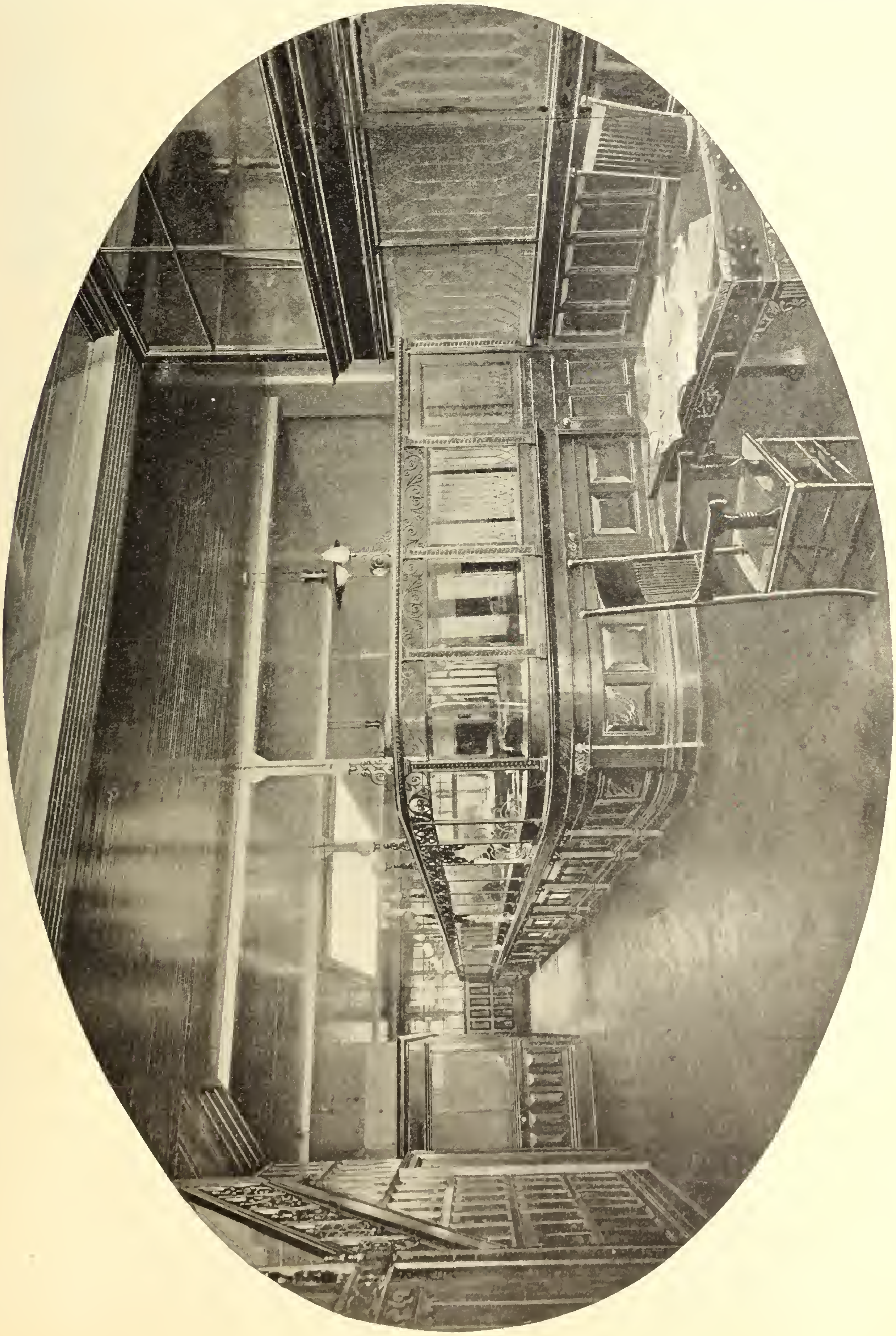
Vol. X. MARCH, 1900 No. 3.



Canadian General Electric Company, Toronto—Interior View of General Offices.

NEW OFFICES OF THE CANADIAN GENERAL ELECTRIC COMPANY.

Owing to the rapidly increasing growth of their business, the Canadian General Electric Company last year found that the accommodation at their head office, 65 to 71 Front street west, Toronto, had become inadequate for their needs. They consequently leased the entire building, Nos. 14 and 16 King street east, and had it remodelled to suit their present requirements and also with a view to providing future accommodation. The alterations were completed about the first of September last, at which date removal to the new premises was commenced.

The new offices are conveniently situated in the centre of the business district of the city. The building is a four story one, with a total floor space of over 25,000 square feet. It is equipped throughout with modern facilities and a completeness of detail particularly suitable for enabling the company to meet the growing demand and better serve the wants of their customers throughout the Dominion.

On the ground floor are situated the general manager's office, board room, offices of the executive officials, and the general offices. A handsome suite of private offices has also been provided for the convenience of out-of-town customers, to whom the company extend an invitation to make use of them for business appointments, etc.

On the first floor is a nicely arranged show-room and a display of samples, representing a wide range of electric light, power and railway material, and general supplies, including switchboards, station and portable measuring instruments, motors, transformers, enclosed arc lamps, fan motors, electric cooking and heating appliances, and numerous other devices, many of which are shown in operation. Those who are directly or indirectly connected with the electrical industry will find a visit to this show room of much interest.

The warehouse is also located upon the first floor and includes the second floor and basement, with a total floor area of about 17,000 square feet. A large and well assorted stock of staple supplies and material is carried. Each floor of this department is connected by a private warehouse telephone system.

Canadian General Electric Company, Toronto.—General Manager's Office.

The entire third floor is occupied by the engineering department, and is laid out in general office, designing, drafting and testing departments.

All of the different departments and floors are rendered easy of access by means of an electric passenger elevator. Among other salient features of the establishment may be mentioned a local telephone system with a central office in the building, thus enabling every department to have direct communication with each other as well as to outside points. A long distance telephone and telegraph office (the Company having its private wire to the works at Peterboro') are also conveniently located in the general offices.

We might go on indefinitely dealing with the innumerable details which go to make up the many valuable appurtenances and conveniences of these offices.

Canadian General Electric Company, Toronto.—View of Warehouse.

Mention might be made, however, of the fact that most of the building is lighted by C. G. E. 5-ampere direct current enclosed arc lamps. This system, which is generally conceded to be one of the best means of artificial lighting, is most satisfactory.

For the accompanying views, showing the general manager's office, general offices and warehouse, we are indebted to the Canadian General Electric Company.

CENTRAL ONTARIO POWER COMPANY.

A charter has been granted by the Ontario legislature to the Central Ontario Power Company, Limited, with a capital of $750,000. The objects of this company are to develop the Burleigh Falls water power, to carry on the business of an electric light, heat and power company in Peterboro', Lindsay, and vicinity; and, subject to provisions of the Street Railway Act, to construct an electric railway in the town of Peterboro', village of Ashburnham and townships of Smith and North Monaghan. The incorporators are: J. A. Culverwell, managing owner of the Burleigh Falls water power; Honourable Richard Harcourt; Eugene Coste, engineer; F. W, Barrett; Dr. Edward Adams, all of Toronto; Robert James McLaughlin, of Lindsay; James Kendry, Peterboro'; H. J. Taylor and H. E. Larkin, St. Catharines, and Honourable Peter McLaren, Perth.

The twenty-third annual convention of the National Electric Light Association of the United States will open in Chicago on the 22nd of May next.

Mr. W. J. Clark, of Toronto, has made application to the Ontario Legislature to construct an electric railway from Mine Centre to Dryden, Ont., and to acquire water powers along the proposed route.

The new electric light plant installed by the city of Winnipeg was put in operation a fortnight ago, and is sa to work satisfactorily. There are 212 arc lights, and the total cost of installing the system was in the neighborhood of $60,000.

Mr. James Ferguson, of New York, was recently in Vancouver forwarding a scheme to transmit electric power to that city from Slave river, 20 miles distant. It is said that a company has been formed and that $200,000 will be expended in installing a plant.

Power's Directory of the electric lighting central stations in the United States, Canada and Mexico continues to reach us every three months. The subscription price of this work is $4 per year, the publishers being E. L. Powers Company, 150 Nassau street, New York.

The Power Publishing Company, World building, New York, have sent us a copy of a recently issued monograph on "Condensers." It consists of a series of lectures and articles upon the subject reprinted from the columns of Power and contains, a vast amount of information. The price is 50 cents.

Canadian General Electric Company, Toronto—View of Warehouse.

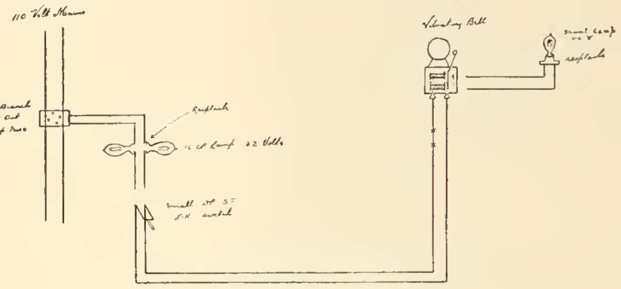
PLAN OF ELECTRIC BELL SYSTEM.

Montreal, February 1st, 1900.

Editor Electrical News :

Dear Sir,—Thinking that some of your subscribers may have occasion to use ordinary electric bells on an electric light circuit, I enclose sketch and herewith offer explanation of a plan found to work very satisfactorily.

By ordinary electric bells, I refer to those which are generally connected with 2 or 3 cells of open circuit battery. There are bells wound to operate, I believe, on 110 volts D.C., but same are not "common stock," and it means delay to procure them. Assuming, therefore, that we have a bell having coils whose resistance are from 4 to 7 ohms, and that the factory manager, having had trouble with batteries running down, and with small boys among the help "monkeying" with same, we will install as per sketch from the electric light circuit, D.C.



Plan of Electric Bell System.

Explanation : We use 52 volt lamps simply so that if there is a bad ground one of the lamps will receive the full voltage and burn out, thus opening the line. The shunt lamp must be the standard voltage of the circuit, in this case 110. The only thing requiring any experiment is this shunt lamp ; possibly an 8 or 10 c.p. may be found to act better than 16 c.p. The shunt lamp is connected to the pivot supporting the armature and to the pillar supporting contact screw back of armature, the object of this shunt lamp being to act as a condenser and absorb the spark which would otherwise ruin the platinum contacts in time.

The switch (or button) being double-poled, the main part of the circuit is open unless just at such time as the bell is in operation. If more than one bell is desired to be rung, cut the wire at points shown x x and continue the circuit, using bells connected for single stroke. These S S bells will, of course, vibrate also in unison with the stroke of the vibrating bell which controls them.

No new principle is involved here, but I am not aware that it has been used thus, although I have seen bells rung by being put in series with one 16 c.p. lamp (on one wire), said lamp being of the standard voltage of the circuit. It is apparent in this style that the sparking of contacts has not been provided for, neither has any provision been made against a 'ground,' as is done in method here shown.

Trusting the above may be of use to some reader, and if acceptable I may give you later an arrangement of alternating current used with success.

Yours truly,

Subscriber.

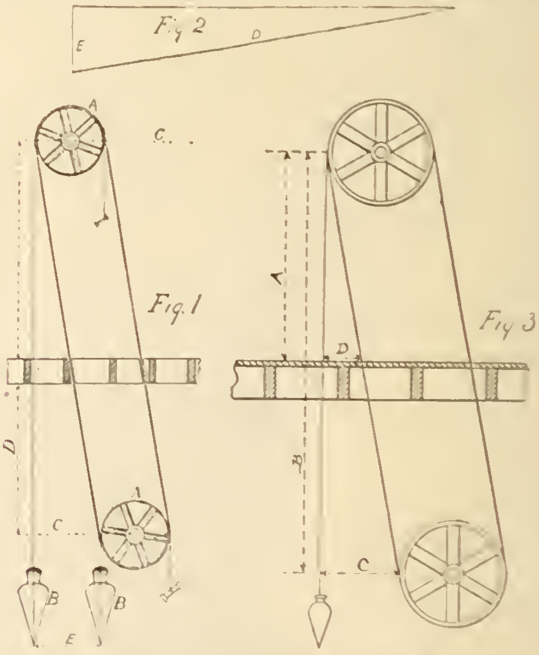
N. B.—Use porcelain insulators and No. 14 electric light wire for installing.

The corporation of Ottawa, Ont., desires tenders by March 13th for fire alarm supplies and coils.

HOW TO CUT A BELT HOLE.

Correspondents to the American Miller have been telling how to find out just where to cut a belt hole in a floor. Fig. 1 shows one method, the advocate which says for it : A A represent the two pulleys. We will draw the line, with plumb-bob B attached, over the top pulley, allowing it to dot the floor, where we will bore a hole for the string to go through. We then allow the plumb-bob to swing clear of this hole and below the lower pulley. Then for accuracy we place a line over the face of the lower pulley, with a plumb-bob attached to it also. Now, to find the degree the two pulleys represent, we measure the distance between the points of the two plumb-bobs, on the line marked E. We then measure between lines C C representing the center of each shaft. By reducing these two measurements to quarters of an inch we find the degree of the bevel D, which is shown in Fig. 2. Set the bevel to this degree, place it on the floor where the hole is to be cut, and rest it on a level ; place a straightedge on the face of the pulley, allowing one end of it to rest on the floor ; bring it to the same pitch as your bevel and you have the center of the hole.

The one contributing the plan shown in Fig. 3 says : All we want is a man with a small auger, a plumb-bob and line, a saw, pencil and measuring tape. Let him plumb down from the face of the upper pulley, dot the floor, bore a hole and pass the plumb line through so it will swing clear from the upper pulley. Measure the distance from center of top pulley to floor, which is shown in the sketch as line A. Then measure from center of top pulley to line C, running through center of bottom pulley. Finally, measure the distance from plumb line to face of lower pulley, which measurement forms the C. Multiply A by C and divide the product by B, which will give the length of D. For example, distance A is 8 feet, distance B 12 feet, and distance C 20 inches. Then 8 times 20 equals 160, divided by 12 equals 13⅓ inches, which is the distance from plumb line to edge of belt hole. Allowance must be made for belt and lacing. If the two pulleys are of the same size the second belt hole will go through the floor at a distance from the first belt hole equal to the diameter of the pulley. If the pulleys are of different sizes, the distance will be about equal to the sum of the diameters divided by 2. Bore small holes and stretch the plumb line over pulley faces to see if measurements are correct, and then saw in whichever direction the holes must go to give the belt plenty of room.



Cutting Floor Holes for Belts.

The Canada Atlantic Railway Co. have inaugurated a system of electrical clocks at terminal points on their line. The clocks are run by storage batteries, and do not require winding. Time is taken from them all along the line at 11 o'clock a. m. each day.

The experts appointed to examine the applicants for the position of engineer of the new municipal building in Toronto have reported that in their opinion none of them reached the necessary standard, and it has been recommended that the council again advertise for applicants for the position. The salary is to be $1,250 per year.

ELECTRIC LIGHTING AND POWER PLANT, VICTORIA HOSPITAL, LONDON, ONT.

One of the most modern and efficient equipments installed during last year was that of the Victoria Jubilee Hospital at London, Ontario. A rigid specification was prepared by the Gilbert Wilkes Engineering Company, of Detroit, under whose supervision the work was installed and tested.

The plant, consisting of two direct connected engines and generators of 43 h.p and 32 k.w. capacity respectively, were to be of noiseless operation, to have a regulation within a two per cent. limit, and a capability of being over-loaded twenty-five per cent. for several hours without injury. The contract was secured by the Electrical Construction Company, of London, Limited, who have installed the entire plant without an objection being raised, and it has been in use now about five months, giving the very best of satisfaction.

Being a duplicate plant, it has been customary for the engineer in charge to run each unit for twenty-four hours, as light and power are required continuously throughout the building. However, beginning with Saturday, 17th February, one of the generating sets was started on a seven day continuous (night and day) run, at the end of which temperatures were taken, showing the following remarkably low temperature rise of the different parts above the surrounding atmosphere :

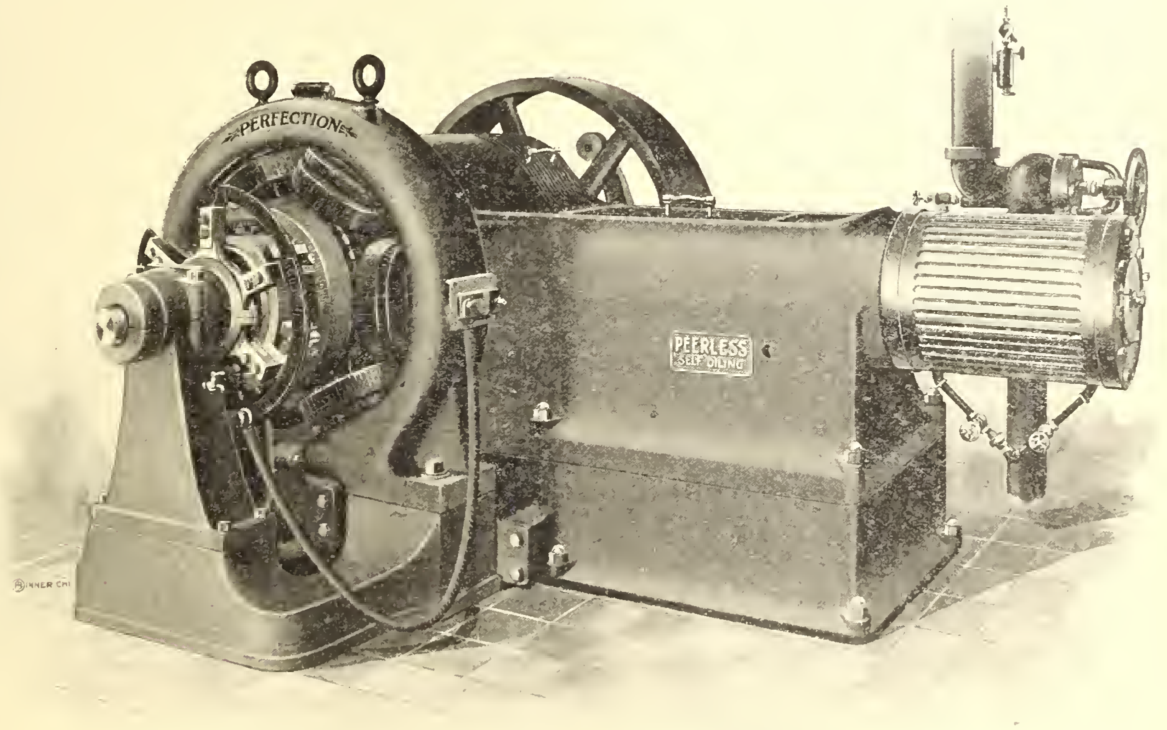
Commutator, 11° centigrade.
Armature core, 17° centigrade.
Crank pin journal, 17° centigrade.
Left bearing of engine, 13° centigrade.
Right bearing of engine, 11° centigrade.
Oil of engine, 16° centigrade.
Field coils of dynamo, 9° centigrade.

Considering that a limit is allowed in general engineering practice of 40° and sometimes 50° centigrade, the above figures are exceptionally satisfactory. During the week the load had varied between 10 per cent. over-load and one-fifth of full load, no adjustment of the brushes being necessary, nor was any special attention whatever required.

The engines, supplied by E. Leonard & Sons, also of London, are of their Peerless self-oiling type, and are lubricated automatically in all parts without attention. Renown engine oil is used for all bearings, and Capitol Renown for the cylinder.

The equipment is electrically controlled by means of a beautiful pink Tennesee marble switchboard, provided with Weston instruments, ten light circuit switches, five motor circuit switches, main switches, pilot lights, ground detectors and rhoestats, making a very compact and well arranged board.

The plant also furnishes power for two direct connected elevator equipments, installed by Messrs. Malloch & Co., of London, the electric motors and controllers of which were furnished by the Electrical Construction Company, of London, Ltd., who also installed two motors direct belted to fans, which are used to exhaust air from the entire building. In all, the Victoria hospital is deservedly proud of its plant, which is entirely of London manufacture.



Electric Lighting and Power Plant, Victoria Hospital, London, Ont.

THE GENERAL DEMAND FOR EDUCATION.

America has become the workshop of the world. Immense resources and economic methods of manufacture enable her to compete successfully with all other manufacturing countries in their own markets, and during the next few years the expansion of her trade will become the talk of the world.

The great impetus recently given to all technical trades and professions by the announcement of a new era of commercial prosperity, has forcibly brought to the attention of the public the great value of technical education, acquired simultaneously with practical experience. The graduate of the ordinary technical university is obliged to accept a minor position in his profession, and trust to his education for rapid advancement. But the ambitious mechanic can make immediate application of his technical knowledge and secure, in the shortest possible time, a lucrative position.

The various engineering colleges are open to but few. Night schools are only found in the larger cities. The International system of instruction by correspondence fully meets the requirements of ninety-five per cent. of the people, by supplying the education for which employers are willing to pay, and pay well.

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AND
ENGINEERING JOURNAL

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Correspondence is invited upon all topics legitimately coming within the scope of this journal

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The Canadian Electrical Association.

A MEETING of the Executive Committee was held at Ottawa recently when all preliminary arrangements were made for the Annual Convention. The dates selected are the 27th, 28th and 29th of June. The headquarters during the Convention will be at the Russell House, where the meetings of the Executive and of the Association will take place. A number of suggestions were received from members relative to subjects for papers, and a committee was appointed to make a selection of subjects and authors. A strong committee was appointed to make the necessary local arrangements, and it is certain, in view of the success which attended the Convention previously held in Ottawa, that the approaching meeting will be one of the best in the history of the Association.

The Discovery of Commercial Incandescent Lighting.

THE article in our last issue referring to the invention of incandescent lighting has awakened considerable interest. The statement was omitted from this article that Mr. Edison's first incandescent lamp patent, No. 214636, was issued April 22nd, 1879, and that the basic patent on high resistance filament was issued May 4th, 1880. Mr. Edison filed his first application for a patent on a paper carbon filament December 11, 1879. The patent of April in that year was really a thermostatic regulator for each lamp. The Ottawa Journal, in referring to the article, quotes the remark of a cynical scientist, that "Mr. Edison has never invented anything, but that a skilful adaption of the electrical adaptions—for the term 'invention' when electricity is the master is rather an uncertain term—and a free use of newspaper advertising has given him his notoriety." The Journal questions our statement that the principle of electric lighting was discovered in Toronto prior to Edison's invention, and dips deep down into the history of electrical science to prove that the principle was known prior to the date of the Toronto discovery. Our statement referred to commercial incandescent lighting, although it was not stated. It is a well known fact that the use of carbon enclosed in a vacuum or gas for the production of continuous electric light was not discovered until the period mentioned. It was well understood, previous to that time, that light could be obtained by heating carbon by means of an electric current, but the carbon, when thus heated in the atmosphere was speedily destroyed, and the light could only be maintained for a very brief period. In connection with this subject the reader is referred to the chapter reproduced in another column from a Brochure entitled "Wireless Telegraphy," by Richard Kerr, F. G. S., describing experiments made in Scotland by James Bowman Lindsay, who is said to have succeeded in lighting his room by electricity, and to have publicly exhibited an electric lamp in Dundee in the year 1835.

The Nernst Lamp.

Referring to the Nernst method of electric lighting as invented by professor Walter Nernst, of Gottingen, Germany, we pointed out in a previous issue that a great drawback to the commercial development of the lamp is the necessity of heating the rod before it will light. Experience has proved that this has been an almost insurmountable difficulty. Numerous patents have been taken out in Germany for a quick-acting, reliable automatic heater, and while a measure of success has been attained, the practical difficulties do not yet seem to have been overcome. We have read a brief account of the first commercial application of this lamp, and it is due to the inventor to state that the claims of high efficiency have been borne out. When Prince Albert of Prussia visited the University of Gottingen, his apartments were lighted with Nernst lamps, and now the lamp is being advertised in that city for house and store lighting. The lamps are to be used on the regular 110 volt circuits. A 25 c. p. lamp operates on 33 watts, or 1.3 watts per candle power. This is about double the economy which has been attained by the incandescent lamp. The Nernst lamps thus far used have the heater placed in close proximity to the staff, and consequently can only be used for low candle power. Another type of Nernst lamp has been invented, however, which is designed for higher candle powers, and which, it is thought, may overcome the objections above referred to. It cannot be said that the experiments have produced results which give promise of bringing it into general use. and for the immediate future at least the present form of vacuum lamp will continue in use. In this connection we may refer to some statistics of the incandescent lamp submitted by Mr. Barstow to the Brooklyn Institute of Arts and Sciences. Mr. Barstow pointed out that the incandescent lamp is now in its twentieth year and that the total production in the United States is about 20,000,000 per year. The different varieties and forms in which the lamp appears number over 147,000. The price of the lamp has been reduced from one dollar to eighteen cents each ; and while the cost today is but one-fifth that of twenty years ago, the efficiency has been increased but three times.

Is Electricity Dutiable ?

THE United States Treasury Department has been asked to give its decision as to the legality of collecting a duty on electricity. The Ontario Power Company purpose generating electric power on the Canadian side of Niagara Falls and transmitting it across the border, where it will be utilized for light and power. Those who desire that a duty should be placed on the electric current argue that it is a vendable and valuable product of manufacture, which can be easily and accurately measured. On the other hand, it is declared that the electric current cannot be regarded as an "article" within the meaning of the law, that it has no power to do work but only serves as a means of transmitting power, and that it is utterly impossible to import electricity because it instantly returns to its source. This question has alway been a debatable one. Some years ago the Treasury Department of the United States handed out a decision to the effect that no duty could be collected. The Dominion Government in 1893 took an opposite view, the Controller of Customs deciding that electricity brought into Canada from the United States should be subject to a duty of twenty per cent., on the ground, if we remember rightly, that it was an "unenumerated manufactured article." The Electrical Review, in support of its contention that no duty can be collected, makes the following original comparison : "Suppose two pulleys, one on each side of the Niagara river, with a rope or belt connecting them. This arrangement would transmit power if one of the pulleys is turned. Similarly, while it was running there would be a more or less rapid importation of the belt, and an exactly similar exportation. And it could not be said with truth that such an arrangement constitutes an importation of power, for the power, in its applicable form, does not exist in transit, but only at the driven pulley. Now this arrangement is an exact analogue of an electrical power transmission."

The Proposed Dodge Telephone Company.

IN another column will be found a letter from the promoter of the proposed Dodge Telephone Company in reply to the article printed in our February number referring to this company. This letter when read in connection with our previous article, must be regarded as being a clever piece of special pleading rather than a clean cut defense of our criticisms of the company's business methods. For example, the promoter states that the company has not decided whether to apply for a Provincial or Dominion charter, and that the decision with regard to this matter will largely depend upon the number of applications which may be received for preferred stock. In another part of his letter, however, he states that the purpose of the company is to operate at first in the provinces of Ontario and Quebec, and afterwards through the Dominion. Seeing that the company could not operate in the two provinces mentioned without a Dominion charter, the reason given for deciding upon the character of the charter and for the delay in obtaining a charter falls to the ground. We deny the contention that it is a usual practice for the promoters of a company to solicit stock before a charter has been obtained and a board of directors appointed. On the contrary, the usual course is to first secure a charter, and second to appoint a strong board of directors in whom the public will have confidence and who will therefore induce investments in stock. If as the promoter states a large number of applications for stock have already been received, there should be no difficulty in appointing a board of directors and in publishing their names. The investing public have also a right to know the character of Mr. Dodge's patents for which he is to be paid the magnificent sum of $1,500,000. As the fundamental patents on telephone apparatus are public property, it would appear that Mr. Dodge's patents must be on subsidiary devices or combinations which cannot be considered essential to the conduct of the telephone business, and the intrinsic value of which is likely to be far below the sum which the company propose to pay to Mr. Dodge. Special stress is put upon the necessity of organizing the company in such a way as that competitive companies shall not be able to secure control of the stock, but the public have a right to enquire who is to guarantee that Mr. Dodge will not sell out his stock, and thus place the control of the company in other hands. Our readers will observe that the promoter offers to waive the clause in the company's prospectus to which special objection was made in the previous article, which gives the company the right to apply to expense account the deposits of applicants for stock, even in cases where their applications may not have been granted. This clause has evidently been dropped because it was found too hot to hold, and we predict that other changes will also have to be made for the satisfaction and security of the public before the proposed company can successfully establish itself.

The Columbia Telephone Co., of Grand Forks, B. C., now operate over 500 miles of line. They propose to extend their system this year into the Similkameen country.

TELEGRAPH and TELEPHONE

DISCOVERY OF WIRELESS TELEGRAPHY.

THE following chapter, reviewing the life of James Bowman Lindsay, who in his day made wonderful experiments with electricity, is taken from a brochure on "Wireless Telegraphy," by Richard Kerr, F.R.S :

JAMES BOWMAN LINDSAY.

Born 1799 : Died 1862.

In giving an account of any discovery or invention, it is but right to give honor to whom honor is due. Therefore we cannot refrain from paying a tribute to the memory of the man who, in these islands at least, was the first to suggest a method of signalling across space without intervening wires. Not only did Lindsay suggest, he also carried out successful experiments in proof of his theories.

It would not be easy to name a greater genius than James Bowman Lindsay, nor a more noble character. Certainly few, if any, have accomplished so much in a life-time of penury. All his life long he must have pinched himself to the utmost limits in order to purchase materials for his numerous experiments. He worked, and worked alone, on the borders of starvation. He had no house ; only one room could he afford, but that one room had in it more than any palace in the kingdom. It was lit up by an electric light of his own installation in the year 1835. It is difficult to realize that sixty-three years ago a room could have been so illuminated. That same room was famous for other reasons. It was here he wrote several of his works, and that portion of his dictionary in fifty different languages, which, in his own handwriting, is in a glass case in the Dundee Museum.

When I saw that manuscript, and the vision of his life struggle passed in a moment through my mind, I removed my hat in reverence for the memory of that poor but rich linguist of Dundee. A short account of what he accomplished under enormous difficulties will be acceptable now that telegraphy without wires is occupying so much attention.

James Bowman Lindsay was born in 1799 at Carmylie, and was taught weaving, and from earliest youth he endeavored to educate himself. In 1821 he entered St. Andrews as a student, working at his trade during the college recess. In 1829 he was appointed lecturer and teacher at the Watt Institution, Dundee. After finishing his arts course, he became a divinity student, but never took license. In 1841 he was appointed teacher in Dundee prison at a salary of fifty pounds. He was a diligent student of science, made many discoveries, and published many works. It was possible that he was the first to use electric light. Not only did he succeed in lighting his one room in 1835, but he publicly exhibited an electric lamp that same year in Dundee. In 1845 he suggested the possibility of extending the electric telegraph to America. In 1853 he maintained that it was possible to establish electrical communication through water without connecting wires. In 1854 he patented this invention. That same year he conducted experiments in London and at Portsmouth, where he successfully telegraphed without wires across water 500 yards wide. In 1859 he telegraphed in this manner across the river Tay at Glencarse, where it is about half a mile wide, and read a paper on this subject before the British association assembled at Aberdeen.

In presence of the members he conducted experiments at Aberdeen docks, which successfully proved the correctness of his theories. During the last two or three years of his life he had a pension of one hundred pounds granted by the Queen on the recommendation of Lord Derby. In his experiments Lindsay was very successful but it is a matter of doubt whether his suggestion as to signalling to America would have met with success, even if facilities had been granted for the trial. At the same time, it is hardly fair to condemn the suggestion in the absence of the man. The genius of the mind that could invent wireless telegraphy, and the indomitable energy that could encounter the labour of writing a dictionary in fifty languages, cannot easily be set aside or even deemed in error ; we do not know all the resources that were behind the suggestion. That his was a prescient mind also will be seen in the remarkable words inserted in the advertisement announcing the opening of his science classes, which appe in the Dundee Advertiser of April 11, 1834: "Houses and towns will in a short time be lighted by electricity instead of gas, and heated by it instead of coals, and machinery will be wrought by it instead of steam, all at a trifling expense." Fancy all this foretold sixty-four years ago. Some of Lindsay's experiments were made in the presence of a turnkey of the gaol and a young friend who is now a venerable old gentleman, highly respected in Dundee. This friend, Mr. Louden, sr., tells me that Lindsay would station them on one side of the Tay, requesting them to watch carefully the needle he had placed in position, and to note how it moved. He would then insert his plates in the water on their side of the river, and crossing over to the opposite side, would complete his arrangements. His battery, containing twenty-four Bunsen cells, would be set in action. Later on Lindsay would return, and question them eagerly as to the behaviour of the needle. The different movements to the right and left would be noted, and, on comparing them with the messages he had sent from the other side, he was perfectly satisfied he had accomplished telegraphy without continuous wires. He would then return to his little room as happy as possible. It is comforting to know that the studious Lindsay, with all his poverty, got some satisfaction and joy in this life. Nowadays we can purchase batteries and wires and all electrical appliances at a moderate cost, and every detail ready for immediate service. It was not so in Lindsay's day. He had to make up his cells, and possibly to coat and otherwise insulate his wires. Mr. Louden knows that Lindsay had to make his own intensity coils, and he tells me that one particular coil used in his earlier experiments was 4½ feet long and contained five miles of wire. Think of it. Think of the cost, and where the money was to come from. Think of the patience of the man with primitive and limited appliances. The modern experimenter in electricity has no difficulties compared with those combated by Lindsay. Besides, in Lindsay's case, more wire, more acids, more metals, ment less food, less new clothes, less comforts of all kinds. Before looking into this remarkable room of his—which if now existing would be a sacred spot to the scientific mind of to-day—let us refer once more to his practical experiments. One of the first demonstrations of his theories took place at Earl Gray dock, Dundee, in presence of many men of science. He immersed seperarate plates in each side of the dock, and transmitted messages with ease and accuracy. Going to a wider expanse of water, he repeated his experiments across the Tay at Dundee and Woodhaven, where the river is nearly two miles wide. These wonderful experiments were the chief topic of conversation at that time in Dundee, but nothing was done to give them a practical bearing. This was not Lindsay's fault. The business of the philosopher is to find out the mysterious forces in Nature, and simply to indicate their application. It remains for others, who have the necessary capital and practical ability, to adopt the ideas and suggestions and to shape them to a useful result. The philosopher's part was done and well done. If the term "philosopher" dces not apply to Lindsay, it never applied to any man. How is it that there is no memoir to this man's life and doings ? Where is the statue to his memory in Dundee ? I have seen statues in large cities to the memory of men not worth remembering—men who rose to fame on other men's shoulders ; men who, in point of morality and genuine worth, were not fit to enter his little room, or to polish poor old Lindsay's boots. But if Lindsay's wishes could be ascertained, he would ask for no statue. It is more than probable he would suggest a large lecture hall, to which the public could have free access to hear unfolded the grand mysteries of Nature, to the study of which his own life was devoted. Doubtless the time will come when the people of Dundee will do their duty, and honor themselves by honoring the memory of Lindsay. Few men who ever saw light on these islands of ours so completely ignored self on behalf of science, or with so much earnestness of purpose have struggled against poverty and accomplished so much ; for it must be borne in mind that "Lindsay's work as a linguist was as remarkable as his scientific discoveries, and would have made a reputation for him rivalling that of Mezzofanti."

But we have not yet peeped into those famous rooms of his. Sir W. C. Leng writes : "James Lindsay the learned Carmylie weaver, died while I was in Dundee, 1862. His rooms (two rooms now that he had a pension) on a flat near the harbor, were walled round with books, and had stacks of books on the floor. His great work in manuscript—a dictionary of twenty-six* languages, lay arrested by death on the table.

"He had got a volume of ponderous bulk, and had ruled it in narrow lines across and across, so as to allow of the equivalent of each word being written in many languages, in a small hand, on the same line as the original. Very pathetic was the testimony borne by that book to the old man's ambition to leave something monumental behind him, and the manner in which his hand had been stopped in the midst of his labors."

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*It was a dictionary of fifty languages.—R. K.

THE DODGE TELEPHONE COMPANY OF CANADA.

To the Editor of the ELECTRICAL NEWS:

SIR,—We observe, not without some degree of satisfaction, that the prospectus of the proposed Dodge Telephone Company of Canada, Limited, has received attention at the hands of your editorial department in the February number of your Journal; and in reply to your criticisms, which we will endeavor to take up, point by point, as closely as may be possible under the circumstances, beg to submit the following statements:

We believe it is not at all unusual for companies of a broadly public character to solicit subscriptions for their stock, prior to the work of organization being entirely completed. And there exists some excellent reasons in their particular instance for deferring for a time this important step. In the first place, the proposed company can procure incorporation under two different joint-stock company acts--the Dominion and the Provincial. The chances are certainly at present all in favor of Dominion incorporation; but a good deal will depend upon the total amount of the 8 per cent. preferred stock, which will be taken up and accepted during the next three or four months. We desire to proceed surely and at the same time very cautiously; and if a sufficient quantity of this stock is placed within a few months hence in hands perfectly satisfactory to the management, a Dominion charter will certainly be obtained. Moreover, we are advised that it may be advisable to apply either to the Dominion, or to the Local Legislature—which will depend, of course, upon the particular Act that will be chosen for our purposes--for certain special legislation, that may be desirable, if not absolutely necessary, in our interests.

With regard to the issue of the prospectus before the Provisional Board of Directors was filled up, we may simply say that we are extremely anxious to select a Provisional Board having the very widest and most representative character possible, and this work has as yet not been finished; still we hope, within a very short period of time, to be able to place before the public a Board whose composition will be equally satisfactory both to ourselves and to the investing public.

With regard to the holding back of a very large block of, and a controlling interest in, the Stock, we can give several reasons, which we consider ample justification for the adoption of this policy.

In the first place, it is no secret at all among those conversant with the manipulation that frequently occurs in connection with the launching of such enterprises, that such an active competition as is intended in this case-which competition is further certainly in the very best interests of the general public-could be prevented in the easiest possible manner by the simple expedient of securing subscriptions for a controlling interest in the stock of the company. This plan was successfully adopted a few years ago in Montreal, and the principal promoter in the present company was still more recently foiled in his plans in New England by a somewhat similar subterfuge. And he thought that in this very instance he had the greater reason to complain, in view of the fact that he was sold out by intimate friends, whom he had benefitted, and who would have been benefited in still greater degree by the continuation of the system which he had been chiefly instrumental in calling into active existence.

Now it may be well to state at this point, and in the most emphatic manner, that the promoters of this company have but one object in view in bringing the claims of this projected telephone company before the public—the establishment upon a permanent basis of a strong independent telephone company to operate, first, in and between the large cities of the Provinces of Ontario and Quebec, and afterwards throughout the remaining suitable parts of the Dominion. We find an impression prevailing in some quarters that it is in the plans of the promoters to sell out eventually to the existing company, but there is absolutely no ground whatever for such a report, which may well have been put in circulation by interested parties. However, enough has happened elsewhere in the United States to give color to such rumors, although the results prove with equal force that the existing company eagerly takes advanage of every available opportunity for effectually extinguishing opposition by a purchase. The controlling interest simply in the Detroit and New State Independent Telephone Companies, for instance, recently cost that organization $1,245,000. The capitalization in question amounted to $2,500,000, of which some $1,400,000 was paid up.

The common stock in the proposed Dodge Telephone Company represents in addition compensation to Mr. Dodge for his patented improvements in telephone instruments and practice, which will be found to be possessed of unusually great value, while a portion, as is not all uncustomary in the case of company flotation, may be used in the shape of promotion stock. The subscribers to the 8 per cent. preferred stock will however be in no way prejudiced in regard to these matters, as they will have an undoubted first lien to the extent of eight per cent. per annum upon the profits earned. And as you are doubtless aware, telephone propositions have been found to be very profitable enterprises.

Finally we may say that there is no intention, and never has been any intention, on the part of the promoters of this company to retain any part whatever of any subscription for stocks, which subscription has not been accepted by the Directorate. However, as many people appear to read the clause in question in a similar light, and as there is now no question whatever of the successful flotation of the company upon the scale desired by the projectors, we have not the slightest objection to drop altogether this particular clause, which would, of course, in that event be wholly inoperative under any circumstances whatever. We have no wish to bring into life utterly useless bugbears, on which hostile influences will naturally seize, in the hope of doing some mischief, even though they do not succeed in their main design—the complete extinction of opposition in the great Canadian field.

And you will be rejoiced to learn, in answer to the concluding portion of your editorial criticism, that many applications for stock have been already received, and that the future prospects of the company are all in all of the most satisfactory possible character. I am,

Yours very truly,
J. A. MACMURTRY.

THE BELL TELEPHONE COMPANY.

The annual meeting of the Bell Telephone Company was held in Montreal on February 22nd. A very satisfactory report of the year's business was presented. The total revenue from exchanges, long distance lines, private lines, etc., amounted to $1,456,682, and the expenditure $1,103,375, leaving a net revenue for the year of $353,307. The statement showed the plant and patents on December 31st, 1899, to be valued at $5,244,436.33. The annual statement was in part as follows: 2841 subscribers have been added during the year, the total number of sets of instruments now earning rental being 34,923. The company now owns and operates 343 exchanges and 450 agencies; 1686 miles of wire have been added to the long distance system in 1899; of these 318 miles are in the Ontario department and 1368 are in the eastern department. The long distance lines now owned and operated by the company comprise 18,920 miles of wires on 6,229 miles of poles. Since the last report, the building in London has been completed, a building has been erected in Parkdale, and a building for the stores department has been erected on Mountain street, Montreal, all of which have been paid for.

The report was unanimously adopted and directors elected as follows: C. F. Size, Robert Mackay, John E. Hudson, Robert Archer, Wm. R. Driver, Hugh Paton, Charles Cassils, and Thos. Sherwin.

SHORT CIRCUITS.

The New Brunswick Telephone Co. have decided to build a line next summer between St. John and St. Stephen, N. B. The company will in the spring commence the proposed line between Fredericton and Chatham.

The Union Telephone Co., of Musquodoboit, N. S., at their annual meeting last month, elected officers as follows: President, Edgar Archibald; vice-president, James Annand; secretary-treasurer, H. C. Taylor.

The Nova Scotia Telephone Co. are considering the advisability of extending their long distance service from Halifax to Sydney, C. B. It is understood that the expenditure would be about $50,000, a large proportion of which would be spent in making cable connection across the straits of Canso. Mr. C. Harris of Halifax, is manager of the company.

The annual meeting of the Montreal Telephone Co. was held in Montreal January 11th last. The annual report showed the total assets of the company to be $2,267,811, divided as follows: Telegraph cables, $33,487; offices and equipment, $212,500; real estate, $279,946; and cash, other real estate, amounts receivable, etc., $115,988. The excess of assets over shareholders' capital was stated to be $151,823, and the contingent fund $7,548. There were declared during the year four quarterly dividends of two per cent. each, a very satisfactory showing. The old board of directors was unanimously reelected, and at a meeting of directors Mr. Andrew Allan was again elected to the presidency.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, Jan. 3rd, 1900.

THE LACHINE RAPIDS COMPANY.

THE annual meeting of the Lachine Rapids Hydraulic and Land Co. was held about two weeks ago. The report of the directors stated, according to the local press, that notwithstanding the fact that since the last annual meeting further discounts had been allowed to customers, the company was firmly established on a paying basis. During the year the expenditure authorized on capital account was $413,709, this representing improvements at the rapids and machinery ordered but not yet delivered. The two 1,000,000 gallon fire pumps had been completed, and steam pipes, with hose, etc., provided and installed. Two of the four generators ordered in 1898 were delivered and put in service. There were at present on the company's circuits 493 transformers, with a total capacity of 66,740 sixteen candle-power lamps. The net increase in incandescent lamps connected to the circuits during the year amounted to 16,114, showing a total of 56,249 lamps connected. The total amount of current sold as power amounted to 1,954 horse-power, being an increase of 1,030 horse-power during the year.

The report stated that several extensions to the underground system of the company had been made, and in this connection the directors referred to the advantages of the underground system. Since its installation there had not been a single accident or interruption. The financial statement showed the gross revenue for the year to have been $164,834.78, and the operating expenses $72,798.10. After paying interests on bonds, a net profit of $69,128.04 was shown.

The directors were re-elected, and at a subsequent meeting they elected officers as follows: G. B. Burland, president; Alexander Fraser, vice-president; W. McLea Walbank, managing director; Robert White, secretary-treasurer.

The case of Wm. Dwyer against Frothingham & Workman for having had his arm paralysed by an electric wire used for an incandescent lamp in the factory of the defendants, and from which the globe had been removed, has been amicably settled by the defendants consenting to pay $600 damages and costs. The man had to be taken to the hospital, where an operation was performed on his arm.

A Mrs. Price appeared a few days ago before the Society for the Protection of Women and Children and made application for funds to enable her to sue for compensation on account of her husband being killed by electricity. She was informed by Mr. Marshall, the secretary, that this did not come within the scope of the Society. The above no doubt refers to a case which happened in this city lately, where an operator at the incinerator was employed on top of a heap of rubbish outdoors in cleaning out some sort of melting pot or crucible with the aid of a long iron rod. The sediment, whatever it was, being evidently stubborn, he raised his rod to take a more forcible blow, with the result that the upper end of the rod crashed into an arc light which was suspended above and which was on a constant current direct current circuit. The man dropped at once and was shortly pronounced dead.

The premises being built by the Estate McIntyre on the site of the old Greenshields warehouse, corner of Victoria Square, and which were destroyed by fire about a year ago, are being wired for enclosed type arc lamps, also for several incandescent drop lights by the Montreal Electric Co. This construction firm are using for the first time in Montreal the Greenfield flexible metallic conduit as manufactured by the Sprague Electric Co., of New York, they deeming it most suitable for use in the peculiar floor construction (fire-proof) being placed in this building.

Messrs. Fred. Thomson & Co. had a small fire on their premises recently, damage being done to the extent of $1,500, covered by insurance. As an offset to the daily papers I would state positively that the fire was due to the deadly "stove," which got overheated.

The Bathurst Power Co., of Bathurst, N. B., is seeking incorporation, to build dams and operate electric and steam plants on the Nepisguit and Tetegouche rivers, in New Brunswick.

CORRESPONDENCE.

THE RECENT ACCIDENT IN MONTREAL.

OTTAWA, ONT., March 3rd, 1900.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—In the February number of your journal appeared an editorial commenting upon an accident in Montreal, resulting in the death of Mr. Alphonse Girouard. This matter was brought up for discussion at the last meeting of Court Elektron I. O. F., which is a Court of the Independent Order of Foresters in Ottawa composed of persons engaged in the electrical business. The undersigned was instructed to write you concerning part of the aforementioned editorial, which is to the effect that "in order to permit of the accident the inside wiring must have been grounded." It was the unanimous opinion of those present at the above meeting that had the inside wiring been subject to a good "ground," the accident could not have happened, as the current would take the much easier path at the grounding of the wires rather than through the body of deceased.

As such accidents may materially effect a large portion of the electrical business, it is thought that this matter should not be let drop until thoroughly discussed and fully investigated, and to this end a further argument on the subject would not be amiss.

Yours truly,

EDMUND J. O'REILLEY.

[An expression of opinion from the electrical fraternity on the above subject is solicited.—THE EDITOR.]

PERSONAL.

Mr. A. T. Smith, superintendent of the Bell Telephone Company, has transferred his headquarters from Kingston to Toronto.

Mr. Stanley Shepard, superintendent of the Valleyfield Electric Company's power house at Valleyfield, Que., has accepted a more lucrative position in Rio de Janerio, South America.

Mr. J. S. Grant, chief engineer of the civic electric light plant of New Westminster, B.C., has tendered his resignation. A successor has been appointed in the person of Mr. J. J. Healey.

Mr. Frank Jackson, a student in the engineering department at Queen's University, Kingston, has received an appointment in the office of the Canadian General Electric Company at Peterboro.

Mrs. Black, mother of Mr. Geo. Black, manager at Hamilton of the Great North-Western Telegraph Company, died in that city a fortnight ago. The deceased was born in Auchterarder, Scotland, and was ninety-one years of age.

Mr. P. Bowler, city electrician of New Westminster, B.C., has resigned his position, and has been succeeded by Mr. Thos. Proctor, of Fort William, Ont. Mr. Proctor was for a number of years electrician on the steamer Empress of India, and also acted in that capacity for the North British Railway.

HOW HE WON SUCCESS.

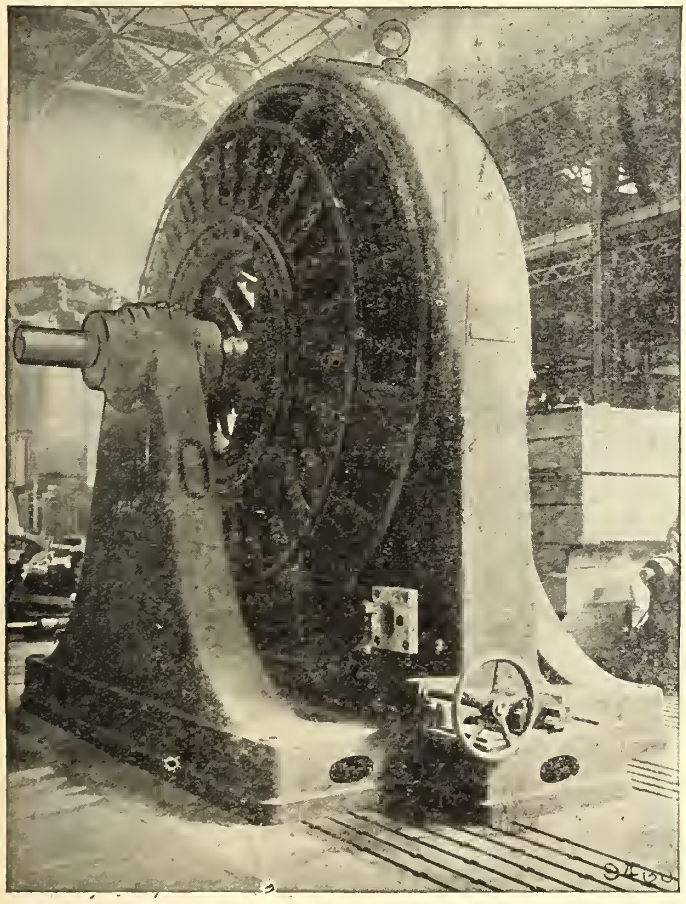
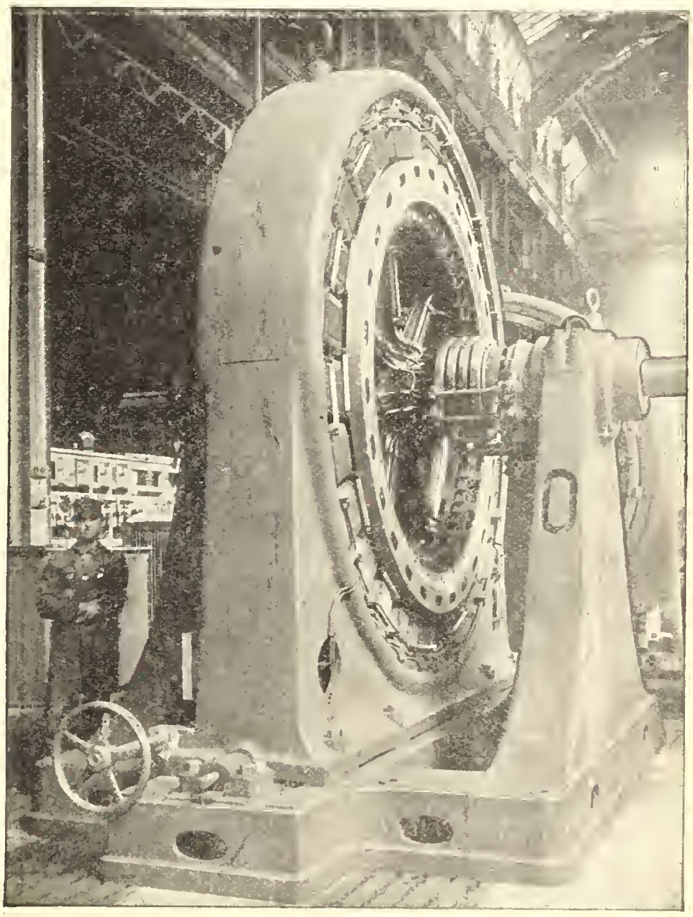
A prominent technical journal in a recent issue contained a pithy paragraph answering an eastern daily which referred disparagingly to correspondence instruction. A reader wrote a letter thanking the editors for their stand and stating that he owed his success largely to a course in a correspondence institution. This is the case of hundreds of men to-day. Never in the history of the world has the poor but ambitious man had such opportunities as are presented to him to-day. It is the lack of technical training that keeps bright young men down. Few can attend college; they are compelled to work every day. But now anyone can have a private instructor. The correspondence institution goes to him at his convenience.

There is no boy so poor but he could manage to pay the moderate charge of the American School of Correspondence, situated at the famous seat of learning, Boston. A careful inspection of the school's attractive instruction papers convince one of the painstaking thoroughness and accuracy which distinguishes the work of this New England institution. The school is chartered by the Commonwealth of Massachusetts, and enjoys the respect and confidence of thousands of earnest students throughout the United States. The instructors are all graduates of leading scientific schools and have had valuable experience along engineering lines. The benefit to the student of this expert supervision cannot be overestimated.

ELECTRIC RAILWAY DEPARTMENT.

DOUBLE CURRENT GENERATERS AND ROTARY CONVERTORS.

In the operation of street railway systems, double current generators and rotary converters promise to form an important part of the station equipment in the future. The Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa., have recently supplied several machines of the above types for street railway work. The double current generators installed by the Metropolitan Railway Co., of Toronto, were described in a recent issue of the ELECTRICAL NEWS. On this page we give illustrations of a 600 k.w. double-current generator installed for the Quebec Montmorency & Charlevoix Railway by Messrs. Ahearn & Soper, of Ottawa, Canadian agents for the Westinghouse Co. This machine is direct connected to a water-wheel, receiving power from the Montmorency Falls, and operates at a speed of 286 revolutions per minute. It has 28 poles, and delivers direct current at 550 volts and two-phase alternating currents at 8,000 alternations and about 400 volts. It will carry its full rate of load on either end, or it will divide the load of direct and alternating current in any proportion that may be required. The direct current is fed into the railway line adjacent to the station and the alternating current is transmitted at a high voltage to a sub-station some distance away.

VIEWS OF 600 K.W. DOUBLE CURRENT GENERATOR—QUEBEC, MONTMORENCY AND CHARLEVOIX RAILWAY.

The Westinghouse Company have supplied for the Third Avenue Railroad at New York, six of the largest rotary converters yet constructed, having ten poles and operating at 300 revolutions per minute. Four of these are now being used as double current generators. They have large over-load capacities, so that when working under full load continuously there is very slight rise in temperature. These machines are rope driven from horizontal steam engines, direct current being taken from the commutators at 550 volts for feeding the railway circuits, and from the collector rings are taken alternating currents at approximately 350 volts. From this pressure these latter currents are raised by means of step-up transformers and transmitted to the 129th street station to operate a similar machine now used as a 1,000 k.w. Westinghouse converter. These double current generators can be changed to rotary convertors whenever desired. This is done by cutting off the shaft and by the addition of a starting motor. The rotating part of the starting motor is pressed upon the armature shaft of the rotary.

It is claimed that to gain the best results with double current generators it is necessary that they be operated at a high speed to avoid a multiplicity of poles. For this reason they are especially well adapted for direct connection to water wheels. The greater flexibility afforded to a station by the use of double current generators is almost certain to bring them into general use for both railway and lighting circuits. Since they are able to deliver their regular output as either direct or alternating current, or a part of each at a low voltage, the direct current is at once available for use on the three wire systems without passing through any auxiliary machinery, aud the alternating current, although not suitable for service at a distance on account of its low voltage, can be raised by transformers.

It is pointed out also that storage batteries may be very advantageously used in connection with double current generators, either to increase direct current capacity at time of maximum load, or to supply the entire output of both direct and alternating currents at time of minimum load, and to regulate the station pressures for both the direct and alternating current at any load.

At a meeting of the city council of Moncton, N. B., it was decided to take steps to compel the Moncton Street Railway Co. to operate its road within six months or take up the rails.

It is understood that an agreement has been reached by which an electric railway will be constructed in the town of Woodstock, Ont. Mr. J. C. Wallace, representing the promoters, states that cars will be running in six months.

The Lulu Island Railway Co., of New Westminster, B.C., have decidtd to build an electric tramway from Granville street, Vancouver, to a point on the north arm of the Fraser river. It is also contemplated to build a branch from New Westminster to the North Arm False Creek line, making about 13 miles new road.

ENGINEERING and MECHANICS

THE GASOLINE ENGINE.[*]

By H. S. Pell.

My intention this evening is to bring before you, in as practical and familiar a way as possible, the main features of the gasoline engine, and I trust that none of my audience will be disappointed if the intricacies of the subject are omitted. In the first place, it would be well to consider the characteristics of the fuel used, viz., 74 degree gasoline. Gasoline, as you all know, is derived from crude petroleum during the process of refining, and being one of the lighter constituents of the parent oil, it possesses not only the quality of inflammability, but is extremely volatile, vaporizing in the open air at ordinary temperatures. I have here a small phial of gasoline, and its volatile quality is readily observed by taking a small portion upon the palm of the hand ; it will be seen to evaporate almost immediately, and it is this quality which makes it specially valuable for power purposes, as gasoline is virtually liquid gas and can be readily mixed with a proper proportion of air and burned under such conditions as to produce motion.

As regards its inflammability, there is a popular impression that gasoline is explosive and extremely dangerous to handle, but this impression springs more from a lack of knowledge than from the facts of the case. As I will now proceed to show you, gasoline burned in liquid form produces a strong, quick flame, but does not give an explosive effect by any means, and when it is considered that such a liquid as gasoline must first become a gas, and further must be mixed with a certain proportion of air before in can be exploded, it will be readily seen that only very simple measures are necessary to ensure perfect safety, viz., handling it by daylight only, and keeping it in air-tight receptacles.

I will now draw your attention to the drawing of a gasoline engine which I have on the platform, and you will at once observe in it a striking similarity to the ordinary steam engine. Both have cylinders, valves, pistons, connecting rods, cranks and fly wheels. As a matter of fact, both are heat engines, the steam engine employing what might be termed external combustion and the gas and gasoline engine internal combustion. There is, of course, an entirely different cycle of operations in the two machines. The steam engine utilizes the energy of some combustible which is transferred to water and carried to the engine in the form of steam. The gas or gasoline engine utilizes the energy of hydro-carbon or other gas, by burning it directly in the cylinder, thus causing expansion of the air drawn into the cylinder on the suction stroke, thus imparting motion to the piston. Chemically stated, the oxygen of the air and the hydrogen and carbon of the gas are the elements which, by combustion, expand the nitrogen of the air and the watery vapor produced by the union of oxygen and hydrogen, and also carbon dioxide and carbonic acid gas formed by the union of carbon and oxygen.

Most commercial engines operate on what is known as the "Otto cycle," which is carried out during two revolutions, or four piston strokes of the engine. We will consider this cycle as applied in the ordinary single acting engine, and commencing with the suction stroke, we will turn the fly wheel and cause the piston to move a full stroke outward. The result is naturally to create a vacuum in the space between the piston and cylinder head, and to open the automatic inlet valve A, allowing air to rush in and fill the cylinder space. This air is drawn through a somewhat restricted opening, and therefore passes through the cylinder ports and enters the cylinder with considerable velocity.

You will notice a little metal cup at the back of the cylinder. This is the gasoline receptacle, and is kept constantly replenished by a small pump operated by the engine and drawing its supply from the main gasoline tank. A small tube projects from the cup into the air part and the swiftly moving air current picks up and instantly vaporizes a few drops of gasoline on each suction stroke from this tube. The cylinder is therefore filled with a mixture of atmospheric and gasoline gas at the end of the suction stroke, and the whirling action of the air current effectively mixes the two elements. The openings for air and gas are so arranged that the proportions are about 8 parts of air to 1 part of gas, which forms a mixture affording the most complete combustion when lighted. The next stroke of the cycle is the compression stroke. Compression of the gaseous mixture gives a more complete infusion, quicker firing and far greater pressure. This compression is effected by the momentum of the fly wheel acting on the piston through the crank and connecting rod, and as both the inlet valve and the exhaust valve open inward, they automatically close on the reversal of the piston. At the end of the compression stroke the contents of the cylinder are at a pressure of about 60 lbs. per square inch in the majority of commercial engines, though both higher and lower compression is used in special cases. The piston is now at its extreme inner stroke, and ready for the third or power stroke. In order to utilize heat energy of the gas it is of course necessary to ignite it, and this is effected in modern engines in two ways, viz., by the electric spark and the hot tube.

By the former method, either a small dynamo, a storage battery or a primary battery is used to produce the necessary electric current. Where the dynamo is used the wires are carried direct to the make and break appliance in the cylinder, but where a battery is employed it is necessary to interpose a spark coil into the circuit. The igniter consists essentially of two conductors, preferably tipped with platinum, which are caused by suitable mechanism to break the circuit at the proper moment for ignition, and thus produce a spark. (The primary cell apparatus I have on the platform produces such a spark by suddenly breaking the circuit as described.) In practice the igniting points are brought into the interior of the cylinder and the spark is produced at the best point to secure efficient ignition of the compressed gases. The hot tube is much simpler than the electric apparatus. It consists merely of a small short tube of iron, nickel, platinum, or composition, open at one end and sealed at the other. The open end is screwed into the engine cylinder, and the tube having been heated to a dull red by a Bunsen burner, fed by gasoline from a small elevated tank, all is ready for work. The tube is, of course, kept canstantly heated by the Bunsen burner during the operation of the engine. When the gases are compressed into the hot tube they ignite at a moment which is controlled by the length of the tube, the shorter the tube the earlier the ignition and vice versa. The moment of ignition can be precisely determined when electric ignition is used, by adjusting the sparkling mechanism, but with the hot tube the time of ignition is more or less experimental, and as ignition at the exactly proper moment is necessary for a complete combustion and good economy, it is evident that the electric spark has a point of advantage in this particular, but when the upkeep of batteries, and sparking points, and the annoying stoppages incidental to the use of electricity are considered, most operators of gasoline engines in my experience prefer the hot tube. The ignition of the gases causes a sudden and vigorous expansion of the air brought into the cylinder during the first or suction stroke, the pressure rising to 200 lbs. or more, according to the amount of original compression and the perfection of the mixture. This causes the piston to take a powerful stroke, and immediately on the completion of this stroke the exhaust valve is opened by a rod and cam and the burned products of the power stroke are swept out of the cylinder, and all is again ready for a new suction stroke, thus completing the cycle of four strokes, which I again name in order, first, outward suction stroke ; second, inward compression stroke ; third, outward power stroke ; and fourth, inward exhaust stroke.

I will now proceed to a brief discussion of the component parts of the gasoline engine, using the part drawing of the Northey gasoline engine on the board for my purpose. In the first place, the bed presents no unusual features apart from its being extra massive and somewhat higher than a steam engine bed would be, owing to the larger fly wheels employed. The shaft runs in heavy bronze half-boxes planed to fit the sockets in frame, and held in place by cast iron caps. This part of the bed is specially stayed to resist the shock of the power stroke. The fly wheels are specially massive, two are used on each engine. The crank shaft is a steel forging. The crank is forged solid, and drilled and slotted out, as the best practice demands, and the whole is very carefully made to withstand the severe duty it has to perform. The connecting rod is a steel forging slotted out at the piston end, and provided with bronze boxes and wedge and screw take-up. It is provided with marine type brasses at the crank end, with turned steel studs, double lock-nuts and split pins. The piston is very deep, as it forms its own guide. It is provided with four or five rings of the spring type. The cylinder is water-jacketed all round, as shewn, this being necessary to keep the temperature of the inner wall of cylinder down to a point at which the special cylinder lubricating oil can do its work. A mineral oil with special qualities must be used, as heavy vegetable oil would thicken and even char in a gas engine cylinder, thus doing more harm than good. As the gasoline engine is a heat engine, this necessary cooling of the cylinder for lubricating purposes is very wasteful, 40% of the heat generated going into the cooling water. The cylinder head is also jacketed, as the inlet valve face in it must be protected from the fierce heat. The inlet valve is a mushroom shaped poppet valve, with a long stem carrying a spring which ensures its prompt closing. It is an automatic valve, which is opened when necessary by the vacuum produced in the cylinder. At the back is the little receptacle for gasoline mentioned earlier in this paper, and entering the bottom of the cylinder will be seen the air pipe with the gasoline injector protruding into it. On the horizontal part of this air pipe is a valve to control the proportion of air used, while the gasoline is varied in quantity by a needle-valve at the base of the gasoline receptacle. The hot tube and bunsen burner apparatus are seen at the top of the cylinder close to the back cover, and the lubrication of the cylinder is effected by a sight feed drop lubricator placed at the forward end of same.

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On the side is the exhaust casing, valve and gear. The casing is water jacketed to protect the valve and seat, and the valve is the same as the inlet valve, viz., a mushroom shaped poppet valve. The value of a poppet valve in gas and gasoline engines lies in the fact that they lift squarely off their seats, and owing to the rush of air or gas through them, the seats are always kept clear of grit or dirt, which soon destroys any valve of the sliding variety.

Poppet valves expand evenly and keep tight under the trying circumstances met with in gas engine practice, and they are easily ground to place when worn or leaky. The proper opening of the exhaust valve is secured by the action of a cam operating a side rod. The exhaust cam is mounted on a secondary shaft which is set in motion from the main shaft by a pair of gear wheels, of unequal size. The gear on the main shaft has one-half the number of teeth of that on the cam shaft. This is necessary from the fact that the exhaust valve is opened once during two revolutions of the main shaft. Where electric ignition is used, the secondary shaft also operates a switch or cut-out, allowing the current to pass only at the beginning of the power stroke, and thus saving the battery. Both inlet and exhaust valves are held to their seats by spiral springs. We have now briefly mentioned the essential parts of the gas or gasoline engine, for a gasoline engine can be easily arranged to use gas. In fact either gas or gasoline can be used at will in the Northey engine. Where gas is used a combined air and gas valve is employed, which automatically adjusts the supply of air and gas in proper proportions.

We will now consider the governing apparatus, taking the Northey engine governor as our example. It will be realized that the governor is a very important part of the mechanism, as its duty is to proportion the number of impulses that the engine will run at practically the same speed from no load to full load. The governor works on the well known principle of centrifugal force operating through a pair of weights so attached to the main shaft as to move a sliding collar along it. This collar has a lip at its outer edge which engages a pivotted finger, the steel tip of which is formed into a knife or chisel edge. This tip moves inward or outward in sympathy with the motion of the governor balls, and is so arranged that it will catch upon a similar chisel edge formed upon the exhaust valve rod. The purpose of this mechanism is that when the engine speeds up a couple of turns more than the normal speed, the pivotted finger is pressed in far enough to catch the detent on the exhaust valve rod and hold the exhaust valve open. The motion of the exhaust valve rod also brings a thin bar of steel behind a collar on the inlet valve stem and holds the valve tight closed. When the parts are in this position the engine cannot draw in a charge of gas or gasoline, and cannot compress because the exhaust valve is wide open. All that can happen, therefore, is that air is alternately drawn in and forced out of the cylinder, incidentally clearing out the spent gases. After a few revolutions the speed of the engine comes down to normal, and as the governor balls come together the governor finger is withdrawn and the exhaust valve closes, while the inlet valve is allowed to open by the withdrawal of the bar. A charge of gas and air is at once drawn in, compressed, fired and exhausted, and the operation is repeated until the governor again comes into action. So perfect is the action of the hit and miss governor, as this type is named, that though the power is applied only every fourth stroke, we are enabled to run a dynamo and operate electric lights with remarkable steadiness and without the intervention of storage batteries.

The method of starting a gas or gasoline engine in the smaller sizes is (after heating up the tube where used, which takes a few minutes) to give the fly wheels a couple of turns by hand. This draws in a charge, compresses and fires it, after which the engine automatically performs its functions. In the larger sizes a so-called self-starter is used, consisting of a small hand air compressor fixed to the side of the engine bed, and a percussion arrangement by which a match or cap gives the spark. The air compressor draws its supply through a small gasoline holder filled with cotton wick and forces a mixture of air and gasoline into the cylinder clearance, the piston being held in place with the crank just above the centre. After a pressure of 20 or 30 lbs. has been reached the match or cap is ignited by the sudden action of a small plunger and the gaseous mixture fired. The air expansion thus brought about causes the engine to take a few rapid revolutions, which suffice to start it. In some cases the engine pumps air under pressure into a tank when working, and this compressed air is used to start the engine when necessary.

The cooling of the cylinder and adjacent parts is effected, as before stated, by circulating water through the jackets provided for the purpose. The water supply is in most cases a sheet metal or wooden tank, with connections at top and bottom. The water in this tank is kept just above the level of the upper connection, and as the cylinder of the engine heats up, a circulation is established through the connecting pipes and tanks. The amount of water required is very trifling. It has been found that the best economy is obtained when the cooling water is kept near the boiling point and tanks are proportioned with that end in view. Where convenient, water under pressure is used for cooling, dispensing with tanks, and sometimes a pump on the engine draws cooling water from a well or convenient stream. The noise made by the exhaust has proved a difficult problem to tackle, as a contrivance which effectually quiets the noise of the exhaust also sets up back pressure and consequent loss of efficiency. The various experiments in this direction have finally sifted down to the plain muffler pot, a plain cast iron covered pot with two openings in the top threaded to receive the exhaust pipes. The purpose of this contrivance is to allow the exhaust to expand where it will make the least noise, and the muffler pot fairly effects its purpose.

Measurement of power in a gas or gasoline engine is practically identical with that in a steam engine, as in both the indicacator affords a diagram which exhibits the necessary data. In a gas or gasoline engine, however, as the power is applied only every fourth stroke, and the engine is single acting, only one-fourth of the total piston speed can be considered in the computation.

It will be noted that the power of a gasoline engine is affected by two factors only, namely, cylinder area and piston speed, unlike the steam engine in which the factors are cylinder area, piston speed and the varying pressure of the steam. In the gasoline engine the mean effective pressure is practically constant, as it is produced by the combustion of gases whose volume and constituents are practically identical in each charge. It follows, therefore, that a gasoline engine should be rated for the market at its brake or actual horse power, and this is done in the case of most engines. The customer who buys a 12 h.p. gasoline engine gets an engine which will develop that power and a percentage over when running at a proper speed, and the facts are guaranteed by the maker. The only way in which the power of the engine can be increased is by speeding it up, so the engine should always be of ample power for the total load. On the other hand, too large an engine should not be chosen, as engines run under power show a marked decrease in efficiency. Experiments with a 12 h.p. gas engine show a consumption of 15 cubic feet of gas per horse power per hour at full load, 15½ at 10 h.p., 16½ at 87 h.p., 18 at 6 h.p., 21 at 4 h.p., and 30 at 2 h.p.

The different applications of the gasoline engine are numerous and interesting. The marine engine, for instance, has so many advantages over the steam engine, particularly for small boats, that as it is perfected it must eventually take first place in this direction. It has no boiler throws off, no heat, needs no firing, and needs a minimum of attention, besides being compact and clean in a marked degree. The marine gasoline engine is not reversible, but a reversible propeller, or a reverse gear mechanism is used. This latter is the well known "Jack in the Box" arrangement and works perfectly. The exhaust is carried overboard under water and is absolutely noiseless; a small pump supplies the cooling water, and the gasoline tank is placed generally in the bow. The Otto or 4 cycle type is growing into popular favor very rapidly, as it is more economical than the two cycle engine, and is perfectly safe because it uses the gasoline in liquid form, while the two cycle engine uses a carburetter or gas-making appliance and thus offers opportunity for explosions. The two stroke cycle engine is so called because it completes its cycle in one revolution. The upward stroke of the piston draws a charge of carburetted air into the base of engine through a check valve, which, on the downward stroke, is partially compressed and forced into the cylinder, where it is fired. The upward stroke, which draws the charge into the base, also completes the compression of the charge in the cylinder. The exhaust takes place through a port uncovered by the piston at the end of its down stroke. Electric ignition is generally used in marine work. The automobile seemed at one time to offer a large field for the hydro-carbon motor, but in my opinion the steam engine and boiler in a refined form offers the best solution of the problem. The gasoline engine is troublesome to start and must be kept constantly in motion. The speed of a gasoline engine cannot be varied to the extent necessary in carriage work, without great complication, and cannot be reversed without introducing the same objectionable feature; while the steam engine has an infinite variety of speeds, its reversal is easily arranged and it will start at the touch of a lever. The engines used for the purpose are beautiful refinements of the ordinary steam engine with tubular frames, steel cylinders and working parts—they are usually twin cylinder engines. The boilers are copper pipe boilers fired by gasoline, and entirely automatic as to firing, steam and water regulations.

The gasoline engine finds a broad field, however, for mining, agriculture and other purposes, and new uses are being found for it continually.

PRODUCTS OF COAL.

The monthly open meeting of the Hamilton branch of Stationary Engineers was held on Tuesday, February 20th. The principal event of the evening was an address by Mr. J. M. Williams, of J. Winer & Co., on the subject of products that could be obtained from coal. The address was illustrated throughout by means of blackboard drawings, and specimens of the various substances named were on exhibition for the inspection of the members present.

It was demonstrated that after the first product, which was heat, the next two of greatest importance were gas and coke. From the coke we obtain electric light carbons and carbide of calcium used in the production of acetylene gas. Coal tar was the next production, and as the substances obtained from the distillation of this tar are practically innumerable, the principal products only were touched on.

We first obtain from coal tar a substance called benzol, which, combined with nitric acid, forms nitro-benzol, which is used extensively in the art of perfuming soap. Next we produce carbolic acid, then creosote, a substance used for preserving railway ties, wharves, etc. Then follows napthaline, used in the manufacture of camphor balls; in exceptionally cold temperature this substance sometimes blocks up the gas pipes. We then obtain solid paraffins, principally in the form of waxes. The last product obtained through the distilling process of coal tar is pitch.

It was then shown how the articles and productions mentioned were applied to the manufacture of modern commodities of everyday use. The explosives used in modern warefare are composed largely of materials obtained from coal, such as carbolic acid, etc.; napthaline goes into some of them and is used in some of the cartridges of the present day. The speaker exhibited samples of cordite and other explosives, and explained how smokeless powder differed from ordinary gun-powder. It was shown how natural articles of commerce were being imitated by productions from coal tar, such as oil of wintergreen, obtained from carbolic acid; musk; saccharine, which is 500 times sweeter than common sugar; and also artificial perfume resembling flower of lilac. In cases of sickness saccharine can sometimes be used where sugar could not. Gum-benzoic, naturally obtained from the juice of a tree grown in eastern countries, a substance which has been used from earliest times in making insense, and in all probability utilized in the preservation of mummies, is now artificially made in the form of benzoic acid. Mr. Williams had on exhibition a piece of gum-benzoic which was over two hundred years old. A substance is also obtained from coal tar which is practically the same as quinine.

At the conclusion of the address a hearty vote of thanks was tendered Mr. Williams for his trouble in preparing such an interesting and exhaustive address on the subject. Mr. L. B. Mann, of Boston, one of the prominent stationery engineers on the other side, addressed the meeting before it closed, and announced that he would be present at some meeting in the near future and address the members at some length. Mr. H. J. Wickens, of Toronto, made a few remarks, and a paper from him on "Electricity" is looked for in the near future.

CONDENSER CAPACITIES.

Mr. A. Aller, writing in Power, gives the accompanying table showing in cubic feet the quantity of condensing water required per minute, concerning which he says: This table enables any engineer to easily determine the condensing water required for a steam engine or steam pump. For instance, if the condenser is required for an engine, say diameter of piston 20 inches, length of stroke 48 inches, speed of piston 600 feet, cut-off ¼, initial steam pressure 80 pounds, by referring to table, 20 inches diameter of piston at 80 pounds steam pressure, for 100 feet of piston speed per minute at full stroke requiries 19.4 cubic feet of water per minute, and at 600 feet piston speed would be 116.4 cubic feet, and when divided by ¼ stroke would equal 29.1 cubic feet of water, or 218 gallons of condensing water per minute, and when condenser is required for pump it is necessary to know how many gallons of water is discharged regularly by pump at a given pressure. For instance: If pump is discharging 500 gallons per minute against 100 pounds pressure or 230 feet head. As one horse power is required for every 2,500 gallons of water elevated one foot high per minute, 500 gallons of water elevated 230 feet high would require 46 horse power. Thus by this simple table the quantity of condensing water required is easily ascertained, as this table is applicable for any style of condenser used for steam engines or steam pumps. You will notice on table in left hand column the horse power gained for every 100 feet of piston speed per minute.

QUANTITY OF CONDENSING WATER REQUIRED PER MINUTE IN CUBIC FEET

Horse-power gained for every 100 feet Piston speed per min.	Diameter of Piston in Inches.	For Every Hundred Feet of Piston Speed per Minute. Steam Pressure in Pounds.																				Diameter of Piston in Inches.
		30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	110	120	130	140	150	
1.03	6	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.0	2.2	2.3	2.5	2.6	2.8	6
1.40	7	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.2	3.4	3.6	3.8	7
1.83	8	1.5	1.7	1.9	2.0	2.1	2.3	2.5	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.9	4.2	4.5	4.7	5.0	8
2.31	9	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.1	4.2	4.4	4.6	5.0	5.3	5.7	6.0	6.3	9
2.86	10	2.4	2.6	2.9	3.1	3.4	3.6	3.9	4.1	4.4	4.6	4.8	5.0	5.2	5.5	5.7	6.2	6.6	7.0	7.4	7.8	10
3.48	11	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.6	5.9	6.1	6.4	6.7	6.9	7.5	8.0	8.5	9.0	9.5	11
4.11	12	3.5	3.8	4.2	4.5	4.9	5.2	5.6	5.9	6.3	6.6	7.0	7.3	7.6	7.9	8.3	8.9	9.5	10.1	10.7	11.3	12
4.85	13	4.1	4.5	5.0	5.3	5.8	6.2	6.5	7.0	7.4	7.8	8.2	8.6	8.9	9.3	9.7	10.4	11.2	11.9	12.6	13.3	13
5.60	14	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.1	8.6	9.0	9.5	9.9	10.4	10.8	11.3	12.1	13.0	13.8	14.6	15.4	14
6.46	15	5.4	6.0	6.7	7.1	7.7	8.2	8.8	9.3	9.9	10.4	10.9	11.4	11.9	12.4	12.9	13.9	14.9	15.8	16.8	17.7	15
7.31	16	6.6	6.8	7.5	8.1	8.7	9.4	10.0	10.6	11.2	11.8	12.4	13.0	13.6	14.2	14.7	15.9	16.9	18.0	19.1	20.2	16
8.28	17	7.0	7.7	8.4	9.2	9.9	10.6	11.3	12.0	12.7	13.3	14.0	14.7	15.3	16.0	16.6	17.9	19.1	20.4	21.6	22.8	17
9.25	18	7.8	8.6	9.5	10.3	11.1	11.9	12.6	13.4	14.1	15.0	15.7	16.5	17.2	17.9	18.7	20.1	21.5	22.8	24.2	25.5	18
10.34	19	8.7	9.6	10.6	11.4	12.3	13.2	14.1	15.0	15.8	16.7	17.5	18.3	19.2	20.0	20.8	22.4	23.9	25.5	27.0	28.4	19
11.42	20	9.7	10.7	11.7	12.7	13.7	14.7	15.6	16.6	17.6	18.5	19.4	20.3	21.2	22.1	23.0	24.8	26.5	28.2	29.9	31.5	20
13.82	22	11.7	12.9	14.2	15.4	16.6	17.7	18.9	20.1	21.2	22.4	23.5	24.6	25.7	26.8	27.9	30.0	32.1	34.1	36.2	38.1	22
16.45	24	13.9	15.4	16.8	18.3	19.7	21.1	22.5	23.9	25.2	26.6	28.0	29.3	30.6	31.9	33.2	35.7	38.2	40.6	43.0	45.4	24
19.30	26	16.4	18.1	19.8	21.5	23.1	24.8	26.4	28.0	29.6	31.2	32.8	34.4	35.9	37.4	39.0	41.0	44.8	47.7	50.5	53.3	26
22.39	28	19.0	21.0	23.0	24.9	26.8	28.8	30.7	32.5	34.4	36.2	38.1	39.9	41.6	43.4	45.2	48.6	52.0	55.3	58.6	61.8	28
25.70	30	21.8	24.1	26.4	28.6	30.8	33.0	35.2	37.3	39.5	41.6	43.7	45.8	47.8	49.9	51.9	55.8	59.7	63.5	67.3	71.0	30
29.24	32	24.8	27.4	30.0	32.6	35.1	37.6	40.1	42.5	44.9	47.3	49.7	52.1	54.4	56.7	59.1	63.5	67.9	72.3	76.5	80.8	32
33.01	34	28.0	31.0	33.9	36.8	39.6	42.5	45.2	48.0	50.7	53.5	56.1	58.8	61.4	64.1	66.7	71.7	76.7	81.6	86.4	91.2	34
37.01	36	31.4	34.7	38.0	41.2	44.4	47.6	50.7	53.8	56.9	59.9	63.0	65.9	68.9	71.8	74.8	80.4	86.0	91.5	96.6	102.2	36
41.24	38	35.0	38.7	42.3	45.9	49.5	53.0	56.5	59.9	63.4	66.8	70.1	73.5	76.7	80.0	83.3	89.6	95.8	102.0	108.0	113.9	38
45.70	40	38.8	42.9	46.9	50.9	54.8	58.8	62.6	66.4	70.2	74.0	77.7	81.4	85.0	88.7	92.3	99.3	106.2	113.0	119.6	126.2	40
50.38	42	42.8	47.3	51.7	56.1	60.5	64.8	69.0	73.2	77.4	81.6	85.7	89.8	93.8	97.8	101.8	109.5	117.1	124.6	131.0	139.1	42
55.29	44	47.0	51.9	56.8	61.6	66.4	71.1	75.8	80.4	85.0	89.6	94.1	98.5	102.9	107.3	111.7	120.2	128.5	136.7	144.7	152.7	44
60.43	46	51.3	56.7	62.1	67.3	72.5	77.7	82.8	87.9	92.9	97.9	102.8	107.7	112.5	117.3	122.1	131.3	140.4	149.4	158.2	166.9	46
65.80	48	55.9	61.8	67.6	73.3	79.0	84.6	90.2	95.7	101.2	106.6	112.0	117.3	122.5	127.7	133.0	143.0	152.9	162.7	172.3	181.8	48
71.40	50	60.7	67.0	73.3	79.5	85.7	91.8	97.9	103.8	109.8	115.7	121.5	127.2	132.9	138.6	144.3	155.2	165.9	176.6	186.9	197.2	50

The officers and members of the Montreal Association of Stationary Engineers recently presented Mr. J. J. York, mechanical superintendent of the Canada Sugar Refining Co., with a handsome silver tea set and tray, appropriately engraved. The presentation was made by Mr. Thos. Ryan, and was intended as a small token of recognition for the efficient services rendered by him as president of the association. The members were afterwards invited to a sumptuous repast at Mr. York's residence.

INTERIOR CONDUITS.

When interior conduit was first placed upon the market, its reception was by no means an enthusiastic one. There seemed to be a strong prejudice against that mode of wiring, and it was thought unnecessary and objectionable by many electrical engineers. The Interior Conduit and Insulation Company, which has since been absorbed by The Sprague Electric Co., was, however, convinced of the necessity for better methods of wiring than had existed up to that time, and perseveringly demonstrated beyond all doubt the desirability and necessity of such a system. From its first step in offering to the public unarmored asphaltic paper conduit, this company claim to have met all the varying conditions imposed by the rapid improvement in the art of modern building construction. The introduction of unarmored conduit was followed by that of brass armored, and later by iron armored. Its latest product is the flexible metallic conduit, now made in all sizes and possessing many features of excellence. A few of the many advantages claimed for this conduit are: By reason of its great flexibility as well as its perfectly smooth and almost frictionless interior, it is entirely feasible to string it over beams and around comparatively sharp constructions, equivalent to many more elbows than might be used in the rigid pipe system in the same situation, and yet retain the wire freedom so essential to drawing in or withdrawing.

The design of the conduit is such that while affording the greatest ease in bending to a curve formation, it absolutely prevents the possibility of flattening. The interior is thus invariably of uniform diameter and symmetrical proportions.

The surface presented to the insulation of a conductor in "drawing in" is less than 20 per cent. of its entire length, while that portion of the insulation in actual contact with the conduit after it has settled to its position can never exceed 25 per cent. of the whole, leaving the balance practically suspended in free air.

Another important feature of the construction of this conduit that will appeal especially to architects and builders is that the outer surface is such that plaster or other surfacing material will rigidly adhere to it, thereby entirely eliminating the unsightly "plaster cracks" so frequently in evidence where rigid conduit has been covered by a comparatively thin layer or "skim coat."

It is generally admitted that the best wire insulations require either to be kept dry or to be completely and continuously immersed in water. Since to effect the latter is impracticable, the problem is to achieve the former as nearly as is consistent with practical methods. It is well known that condensation or "sweating" takes place with great freedom in unlined metal pipes, and also that the water so condensed will be retained within a pipe system indefinitely, resulting in keeping the wires moist without completely submerging them, thus absolutely guaranteeing the ultimate destruction of their insulation. Now, were the same pipe thoroughly ventilated throughout every unit of its length and its diameter, it is apparent that the products of condensation would not be retained. In fact, there would not be any condensation.

Flexible metallic conduit is just such a ventilated pipe; by reason of its spiral formation there is no unit of its length or of its diameter without its vent. Wires placed in such a conduit are of necessity maintained in a condition as free from moisture as is physically possible short of hermetically sealing them, which, as is now known from long experience, is practically impossible.

The destructive action of a short circuit in unlined rigid tube is too well understood by electrical engineers and others to require extended discussion here; it has been demonstrated, however, by actual experiment, that such destruction cannot occur in the flexible metallic conduit on account of its perfect ventilation, which allows the energy of a "short circuit" to be dissipated throughout every unit of the conduit section in which it develops, leaving the interior of the conduit as perfect as before the occurence of the "short circuit."

Experiments with nails, hammers, saws and other tools have clearly demonstrated that flexible metallic conduit has mechanical strength superior to commercial gas pipe of the same wall thickness and of approximately the same interior diameter, therefore as a satisfactory protecting envelope for insulated conductors it is more desirable than any form of conduit at present manufactured; the formation of the outer metal ribbon presenting an almost impenetrable surface to nails, etc.

The tools required for installing Greenfield flexible conduit are few and simple. An adjustable vise is provided for holding the tube while it is cut with an ordinary hack saw. A reaming tool, similar to that used with iron pipes, removes the slight burr caused by the saw.

An additional protection against any possible injury to insulation while the wire is being drawn in, is provided by a small, soft metal bushing which is inserted in the end of the tube and secured permanently by an expanding tool. When the bushing is inserted in the end and the expanding tool applied by a strong pressure of the hand it forces the metal into the spiral formation of the tube, making a smooth and frictionless finish to the end.

The National Underwriters Association has decided that conductors used in this conduit should have insulation equal to that required for conductors installed in uninsulated metal conduit, as shown in their Rule No. 40, Class D, and that the conduit will be approved under the same conditions imposed by them on any other uninsulated pipe.

As it is manufactured in lengths of 100 feet, and as the circuit divisions in interior wiring rarely exceed that distance, it follows that no necessity exists for a break in the continuity of a division from junction box to outlet. But the great gain is in the saving of time, labor and cost of construction, as it is obvious that there are no elbows with their diminished cross section, no threads to cut, and consequently no burden of tools to constitute a workman's equipment. Again, while many contractors have thought on account of its many advantages that it was more expensive than the plain rigid iron pipe, this is quite a misconception, as in addition to the saving it effects in elbows, and couplings, and labor in installation, the conduit itself is somewhat cheaper. The use of this conduit therefore solves the problem of rendering an uninsulated "plain" metal conduit thoroughly reliable, safe, and in all respects a satisfactory protecting envelope for the insulated wire it encloses.

The Sprague Company still maintains its position as the pioneer in this department of electrical fields. All its manufactures are approved by the National Board of Fire Underwriters, and may therefore without hesitation be recommended for every kind of interior wiring.

Persons interested may obtain further particulars or catalogues from the Canadian sales agents, Messrs. Jack & Robertson, 7 St. Helen St., Montreal.

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 6.20	A.M. 5.40	11.20
2....	" 6.20	" 5.40	11.20
3....	" 6.20	" 5.40	11.20
4....	" 9.00	" 5.30	8.30
5....	" 10.20	" 5.30	7.10
6....	" 11.30	" 5.30	6.00
8....	A.M. 12.20	" 5.30	5.10
9....	" 1.10	" 5.20	4.10
10....	" 2.00	" 5.20	3.20
11....	" 2.30	" 5.20	2.50
12....	" 3.00	" 5.20	2.20
13....	" 3.20	" 5.20	2.00
14....	No Light.	No Light.	.....
15....	No Light.	No Light.	.....
16....	No Light.	No Light.	.....
17 ...	P.M. 6.40	P.M. 9.00	2.20
18....	" 6.40	" 9.45	3.05
19....	" 6.40	" 10.45	4.05
20....	" 6.40	" 11.45	5.05
21....	" 6.40	A.M. 12.40	6.00
22....	" 6.40	" 1.40	7.00
23....	" 6.40	" 2.30	7.50
24....	" 6.40	" 3.20	8.35
25....	" 6.50	" 4.00	9.10
26....	" 6.50	" 4.40	9 40
27....	" 6.50	" 5.00	10.40
28....	" 6.50	" 5.00	10.10
29....	" 6.50	" 5.00	10.10
30....	" 6.50	" 5.00	10.10
31....	" 6.50	" 4.50	10.00
		Total.........	189.00

The owners of the Velvet Mine in British Columbia purpose constructing a railway from Rossland to the mine. It is probable that electricity will be the motive power. Upon this point a director of the British Electric Co. will shortly make a report to the owners.

SPARKS.

The Louisburg Electric Water and Power Co., of Louisburg, C. B., is seeking incorporation.

The Lay Whip Co., of Rock Island, Que., intend erecting a new factory, to be operated by steam power.

The Montreal Street Railway Co. have fitted up club rooms for their men at the corner of Cote and Vitre streets.

The two companies applying for charters to build an electric railway from Ottawa through the Winchester district to a point on the St. Lawrence river have amalgamated.

Mr. W. T. Stewart, electrical engineer, of Toronto, has been engaged to prepare an estimate of the cost of a system of street and commercial lighting for Toronto Junction, Ont.

Negotiations are said to be in progress for the location at Brantford, Ont., of a well known firm of manufacturers of electrical apparatus, whose headquarters are in the United States.

The electric light plant at Huttonville, Ont., was completely destroyed by fire on February 15th. The plant was used for lighting the town of Brampton, four miles distant, and was insured for $3,000.

A gentleman has made a proposition to the town council of Collingwood, Ont., to establish smelting works and rolling mills there. He agrees to expend $1,300,000 on the plant. It is his intention to utilize the blast furnace gases for the production of power to operate the blowing engine and electric plant that will be installed for driving the machinery.

Mr. Clyde K. Green has entered upon his duties as traffic manager of the electric railway system of the Cataract Power Co., of Hamilton, and Mr. J. B. Griffith, late manager of the Hamilton street railway, has been installed as purchasing agent of the syndicate. Mr. H. R. Leydon has successed Mr. Gordon J. Henderson as manager of the Hamilton Electric Light & Power Co., and Mr. Henderson will be appointed to another position in connection with the company's plant.

The annual meeting of the Halifal Electric Tramway Co., Limited, was held at Halifax on February 12th. The statement of the directors showed a net profit of $61,798, as compared with $54,748.54 for the previous year. The percentage of operating expenses was reported to be lower than in any previous year, showing a decrease of 3.91 per cent. as compared with 1898. The car mileage increased during the year by 20,334 car miles, and 2,616,231 passengers were carried, an increase of 196,963 over the previous year. The total instalment of incandescent lamps throughout the city was given as 17,267. The power station equipment was increased by a constant current alterating arc lamp transformer of 100 lamps capacity, a line transformer of 50,000 capacity, and 110 meters. Mechanical stokers were placed under one boiler.

Messrs. Wright & McKinley, of Seaforth, Ont., are still negotiating with Dr. Norton for the purchase of the electric light plant at Shelburne. If an agreement is reached they agree to supply lights at the following rates on a five year contract: For lighting streets from dusk until midnight, and eleven o'clock on Sundays, with 26 arc lamps, run on moonlight schedule, $500; for lighting town hall and public library with 20 incandescent lights of 16 candle power, $25. Rates to private takers would be: 1 to 3 lights, 16 c.p., 40c. a month; 4 to 10 lights, 16 c.p., 35c a month; 11 to 15 lights, 16 c.p., 33c a month; over 15 lights, 16 c. p., 30c. a month. Bed room lamps, 8 c. p., $2 per year; 10 c.p., $2.25 per year; 16 c. p., $2.77 per year. Halls and churches, $1.50 per 16 c. p. per year. Cleat wiring, $1 per lamp. Concealed wiring, $1.25 per lamp.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED THOMSON & CO.
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. Telephone Main 3149.

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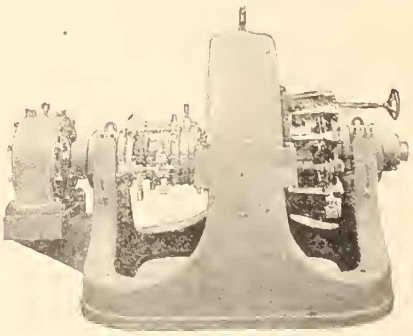

ROTARY CONVERTER.

Give Satisfaction for all kinds of Service . . . .

Ahearn & Soper - Ottawa
AGENTS FOR CANADA

SPARKS.

The Victoria Telephone Co., of Woodville, Ont., at a recent meeting, decided to extend their line to Lindsay.

The British Columbia Electric Railway Co. intend to do considerable double-tracking in the city of Victoria.

It is said that the Montreal Street Railway Co. have decided to provide special cars for the convenience of smokers.

A new building will be erected in Montreal for the Canadian Pacific Telegraphs, the plans for which are now being prepared by Maxwell & Shuttuck, architects.

The town council of Richmond, Que., have given a five year contract for street lighting to the electric lighting company of that place, at the price of $1,000 per year.

The corporation of the village of Beaurivage, Que., is seeking power from the Quebec Legislature to construct an electric railway within the municipality and connecting with the city of Montreal.

Messrs. Peter Ryan and John Shields, of Toronto, have submitted to the council of Kamloops, B.C., a proposition to establish electric light and waterworks systems costing $100,000, provided they are given a franchise for thirty years.

The transport "Milwaukee," which was chartered to carry the Canadian cavalry to South Africa, was fitted with electric lights. The installation includes a 10 k.w. multipolar dynamo and switchboard, which is being supplied by the Royal Electric Co. This is the second transport for which this company have supplied the electrical apparatus.

JOHN R. BARBER, President. *GEO. E. CHALLES, Sec.-Treas.*

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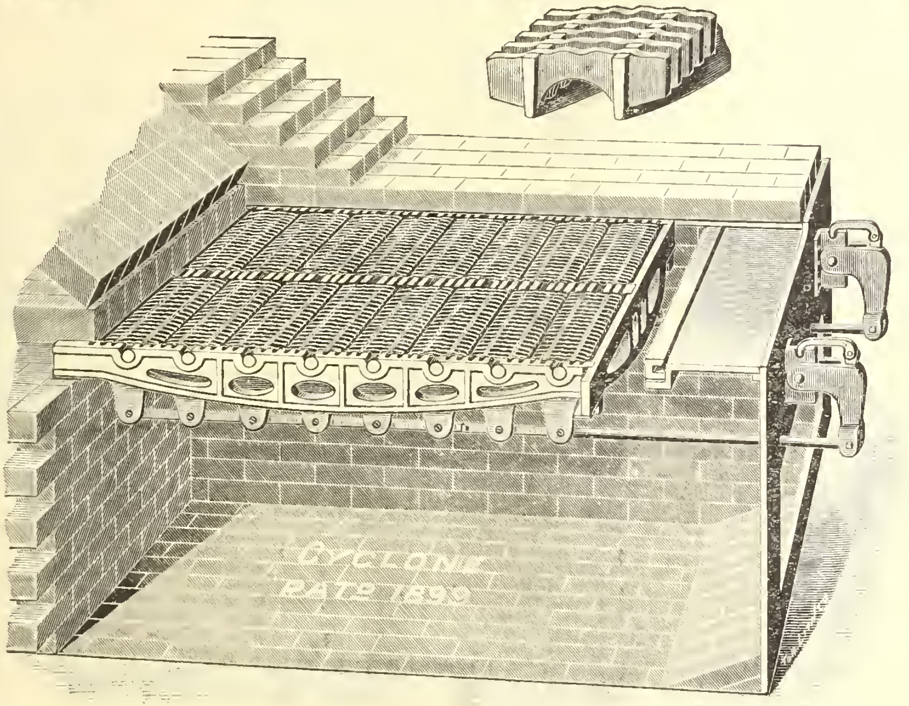
Economy of Fuel and Increased Boiler Efficiency Guaranteed

Cut shows construction of the Grate. No alteration of Plant necessary.



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When installing new Boilers specify Cyclone Shaking Grate.

We furnish plans and specifications for setting Boilers by most modern method, to ensure economy of fuel.

We also remodel old plants to ensure the best economy in connection with our Grate Bars.

We make one claim—that we agree to evaporate more water per pound of coal than any other device in America.

THE CYCLONE GRATE BAR COMPANY
(Limited), Toronto.

TORONTO JUNCTION, Ont., Jan. 20th, 1900.

GENTLEMEN,—We take much pleasure in giving you our testimonial re Grate Bars. The set you put in for us is giving perfect satisfaction. They are very convenient to operate, have ample air space, and are very economical regarding fuel.

To every intending purchaser we would advise to adopt the Cyclone Grate Bar in preference to any other kind. Wishing you every success, we are,

Yours truly,
WATT & WATSON.

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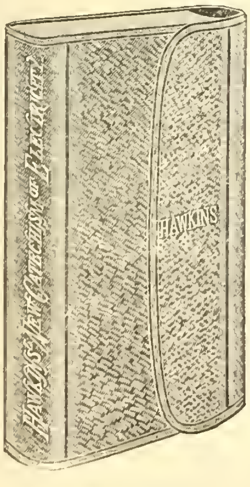
Cyclone Grate Bar Co., Limited

Telephone 1106. Office: 10 King Street West, TORONTO, CAN.



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ELECTRICITY
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FOR ENGINEERS AND DYNAMO TENDERS

Engineers desiring a practical book on every-day electrical practice will find that this book fills all requirements, as it treats fully upon Dynamos, Motors, Wiring, Electric Lighting, Bell-fitting, Electric Batteries, Telephones, Electric Elevators, Pumps and Railways. It is also in itself a dictionary of Electrical Words and Terms. The volume is bound in handy pocket-book form, red leather, gilt edges and gold titles. It has 550 pages of up-to-date information, and is fully illustrated with 300 cuts.

This work will be sent postpaid upon receipt of $2.00 to any address in any part of the world. To the patrons of the ELECTRICAL NEWS it will be supplied, if desired, on easy terms of payment, i. e., $1.00 with order and $1.00 in 30 days Send remittance by Post Office or Express Money Order. Book will be sent on first payment.

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Send me, postpaid, "Hawkin's New Catechism of Electricity."

Enclosed find One Dollar to cover first payment. If the book proves as advertised, I hereby agree to send you the remaining dollar within 30 days.

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THEO. AUDEL & CO.
PUBLISHERS
63 Fifth Avenue (corner 13th Street) - NEW YORK

SPARKS.

The village council of East Toronto is looking into the question of installing an electric light plant.

Various sites have been visited by the city council of Halifax, N.S., which has decided to establish a municipal electric light plant.

The United Electric Co., of Toronto, purpose erecting new factory buildings, increased business having made larger works necessary.

A by-law will likely be submitted to the ratepayers of Yarmouth, N. S., to provide the sum of $13,000 for a steam pumping plant for the waterworks system.

Messrs. W. A. McLean, D. Robertson and others have been incorporated as the Walkerton Electric Light & Power Company, of Walkerton, Ont., with a capital of $30,000.

It is stated that the Dominion government has decided to install a storage battery plant at Hamilton beach, and to light the piers and approaches to the canal by electricity.

A very attractive booklet descriptive of the Lundell motor has been received from Messrs. Jack & Robertson, of Montreal, Canadian agents for the Sprague Electric Company.

The Canadian General Electric Company are in need of additional factory accommodation, and it is probable that they will erect a large addition to their works at Peterboro, Ont.

The E. B. Eddy Co., of Hull, Que., have awarded the contract for electric motors for operating their factory in Hull to Ahearn & Soper, Canadian agents for the Westinghouse Company.

The mayor of Winnepeg has announced that he will introduce a by-law to provide $300,000 for the installation of a municipal gas plant, also that he will take steps to secure the franchise for private electric lighting.

The Crow's Nest Pass Electric Light and Power Co. has been incorporated by the Government of British Columbia. It is proposed to develop water powers and supply electric light and power to the town of Fernie and vicinity.

Some idea may be gained of the output of the Goldie & McCulloch Co., Limited, of Galt, Ont., when it is known that they sold 34 engines the first 47 days of the present year. They are busy is all their other departments as well.

Messrs. W. B. Snowball, R. A. Snowball, Geo. E. Fisher, R.A. Lawlor and D. G. Smith are seeking incorporation as the Chatham Electric Light Co., capital $50,000, to carry on an electric lighting business in the vicinity of Chatham, N. B.

Mr. M. Kyle, of Rat Portage, Ont., when in Toronto recently, stated that as soon as the mines of the Gold Panner Mining Company were established on a firm basis, a water power would be utilized and the entire plant operated by electricity.

One for the New Midland Elevator Co., one for the Beaver Portland Cement Company, Marlbank, and three for the Linde British Refrigerator Co., of Montreal, are among recent sales of Wheelock engines made by the Goldie & McCulloch Co., Limited, Galt, Ont.

The C.P.R. Telegraph Company have decided to purchase the building now occupied at the corner of Hospital and St. Francois-Xavier streets, Montreal, and in the spring to erect on the site thereof a new building so planned as to meet the requirements of their rapidly growing business.

A committee of the council of St. Mary's, Ont., visited the towns of Goderich and Seaforth to secure information regarding the operation of waterworks and electric light plants. This committee has recommended that the town assume control of all private electric lighting and that additions be made to the plant.

Among recent sales this year of Ideal high speed engines made by the Goldie & McCulloch Co., Limited, of Galt, is one for St. Francois-Xavier College, Antigonish, N. S., two for Canadian General Electric Company, and one for Wm. Cowan & Co., Prince Albert, N. W. T. These engines are in demand all over the Dominion, as the above orders show.

The T. Eaton Company have decided to remove their entire engineering department from its present location in the main building to a new building recently erected on the north side of Albert st., Toronto. As this is one of the largest isolated electric and steam plants in the Dominion, this change will involve a vast amount of labor. The chief engineer of this plant is Mr. E. J. Philips.

METERS

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To Officers and Managers of Central Stations:

The Duncan Integrating Wattmeters manufactured by the Siemens & Halske Electric Company of America are constructed after my design and under my personal supervision.

The great facilities of this Company have enabled me to complete many improvements heretofore contemplated but never until to-day accomplished.

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Some Types of

MANHATTAN

Alternating Current Arc Lamps

STYLE NO. 200.
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You are invited to investigate our A. C. Series Enclosed Arc System.

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to provide for any percentage of circuit.

C^2R Loss constant at all loads = 200 watts.

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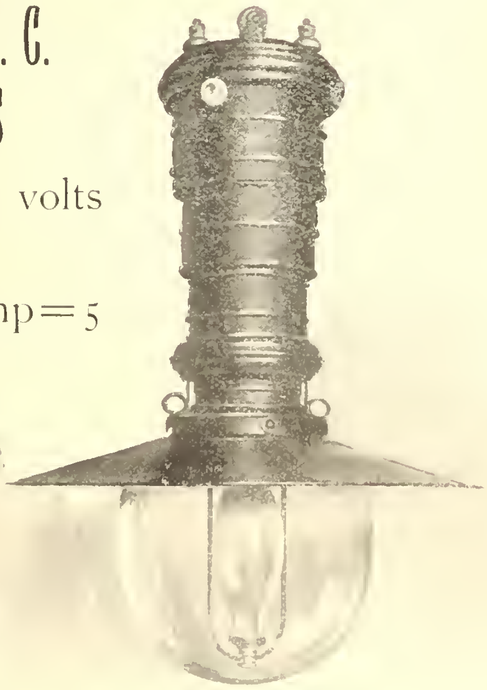
At 6.6 amp. 72 volts arc = 430 watts.

Total loss in lamp = 5 watts.

Efficiency = 99%.

Power factor complete circuit of Lamps and Regulator = .89.



STYLE NO. 1083.
C. G. Trim. Iron.

Manhattan General Construction Co.

Head Office: NEWARK, N.J. Canadian Office: Temple Bldg., TORONTO, CAN.

SPARKS.

The Canadian General Electric Company have subscribed $1,000 to the National Patriotic Fund.

Mr. R. A. L. Gray, electrical engineer and contractor, Toronto, has removed to new and more convenient offices in the Rossin House block, 83½ York street.

It is understood that a company will apply for a charter to operate a street railway in the municipalities of Fairville and Carleton, adjoining the city of St. John, N.B.

It is reported that the Cataract Power Company, of Hamilton, will extend their radial railway system to Oakville at an early date. It is also stated that the Toronto Street Railway Company will build a road west to the same point, thus completing an electric railway system between Toronto and Hamilton.

The city of Montreal and the Montreal Street Railway Co. have agreed to ask the courts to decide the proportion of cost to be borne by each for the removal of snow from the streets during the winter. The street railway company has, in the past, paid two-thirds of the costs, but the old contract having expired, the company wish a new agreement entered into on the half cost basis.

Messrs. Wallace & Little will make application at the coming session of the Ontario Legislature for the incorporation of the Woodstock, Thames Valley & Ingersoll Electric Railway Co., to construct an electric railway through to the town of Woodstock, and of West Oxford to Ingersoll, with branches to other points.

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FEATURES WORTH REMEMBERING

High Speed, Close Regulation, Great Capacity
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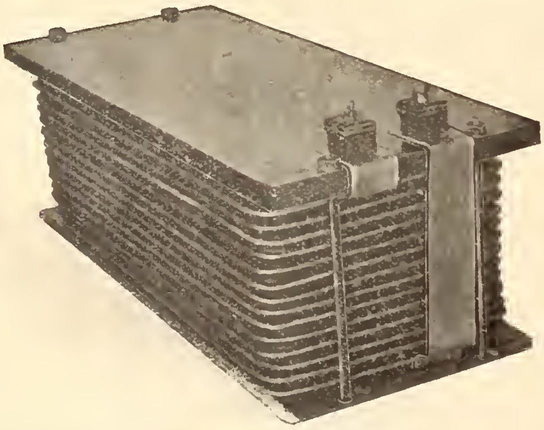
RECENT PLANTS INSTALLED:—Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Cataract Power Co., Hamilton, Ont.

CORRESPONDENCE SOLICITED.

The Stilwell-Bierce & Smith-Vaile Co. = *DAYTON, OHIO. U. S. A*



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on new Lines.

All containing cells and excessive acid omitted;
Piles of any voltage, any capacity, in one unit;
Less space, less weight, less price.

Volta Electric Storage Co.
HAMILTON, CANADA.

Scientific American, Oct. 14, 1899.

The Automobile Magazine has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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THE AUTOMOBILE MAGAZINE

31 State Street,
NEW YORK.

$3.00 A YEAR.

N. Y. Evening Post, Oct. 9. 1899.

The new illustrated Automobile Magazine (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

A Series Alternating Street System

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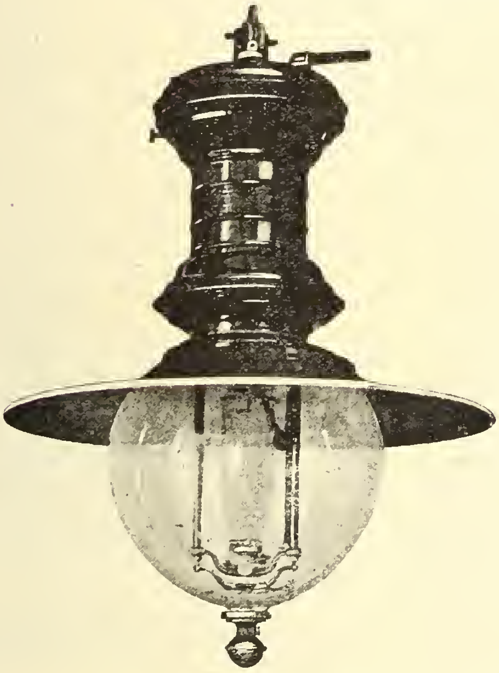
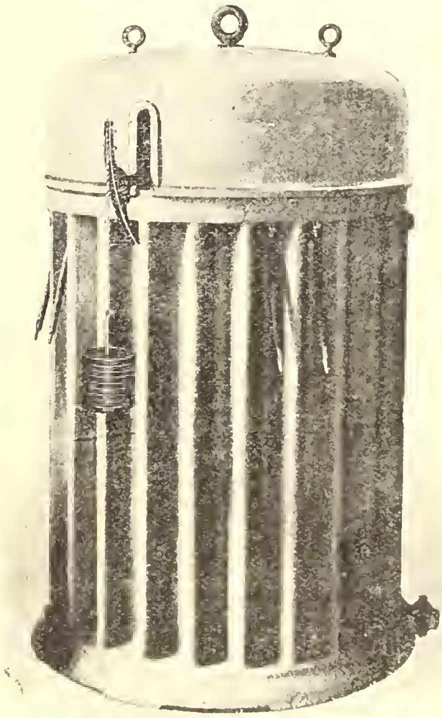


Our Constant Current Transformer can be operated on any Potential, or any periodicity, and on one, two or three circuits without additional constant Potential Transformer as required when so called "regulator" is used.



Power factor and efficiency highest attainable.

No destructive grounds or short circuits with other lines where our Transformer is used.

If you contemplate a change we can show you results which **HAVE NOT** and **CANNOT** be attained with any other system.

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CANADIAN GENERAL ELECTRIC CO'Y

LIMITED

The Largest Manufacturers of Electrical Apparatus under the British Flag.

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TORONTO, ONT.

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PETERBORO', ONT.

BRANCH OFFICES:
HALIFAX MONTREAL WINNIPEG ROSSLAND VANCOUVER

SPARKS.

Tenders have just been taken for lighting the streets of the town of Napanee, Ont., for a period of ten years.

The Royal Electric Company, at a meeting of the directors held a fortnight ago, declared a quarterly dividend of two per cent.

The corporation of Hull, Que., will shortly let the contract for lamps, wires and fixtures for the new arc lighting system. There will be 75 arc lamps.

Mr. L. E. Gauthier, of Montreal, is preparing plans for a boot and shoe factory to be erected at Hull, Que., in which there will be installed several electric motors.

The Montreal Street Railway Company proposes to place its wires underground. The manager, Mr. F. L. Wanklyn, states that it has been decided to expend $200,000 on a conduit system which has become necessary owing to the large number of cars on the streets. The work will last about nine months.

The Chambly Water & Power Company have commenced the construction of a new tail race at Chamby in order to develop the entire water power. The contract has been given to P. Lyall & Sons.

Mr. Geo. C. Robb, of the Boiler Inspection & Insurance Co., has recommended that two new horizontal tubular boilers of 125 h.p. be installed in the Machinery Hall of the Toronto Industrial Exhibition.

The Underfeed Stoker Company of America was incorporated last month in New Jersey, with a capital of $1,000,000, to manufacture an automatic stoker. The incorporators include Messrs. Geo. Gooderham, W. R. Brock, T. Rowan, J. L. Ross, Elias Rogers, Lloyd Harris, and J. B. Dill, of Toronto.

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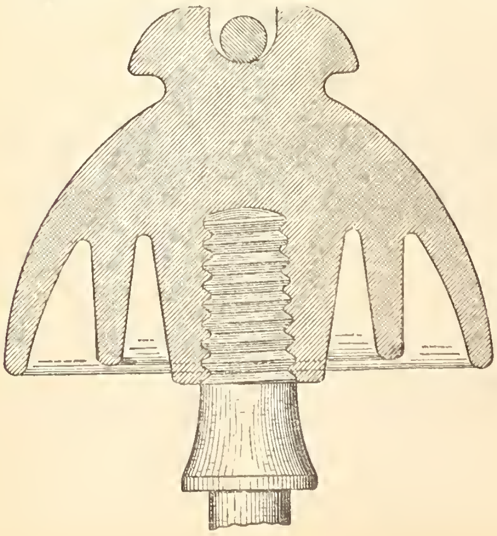

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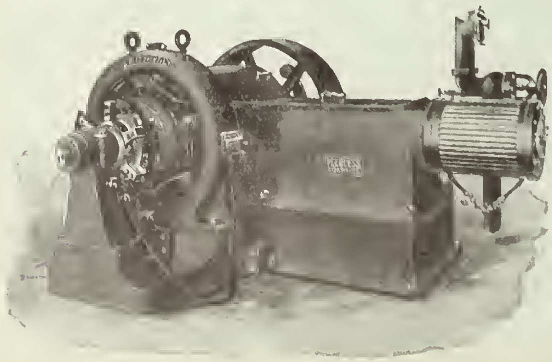

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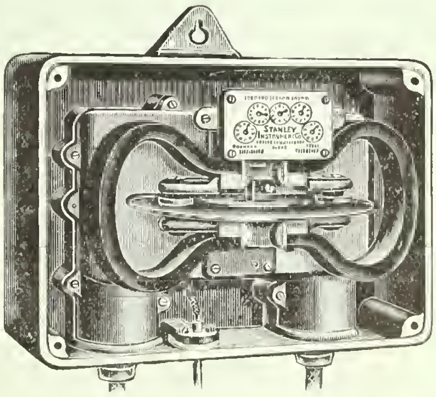

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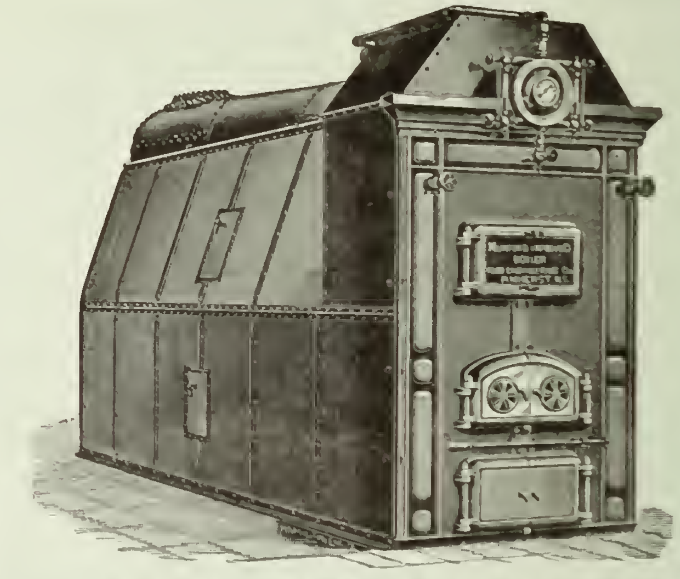

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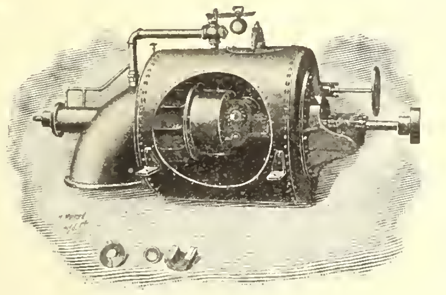

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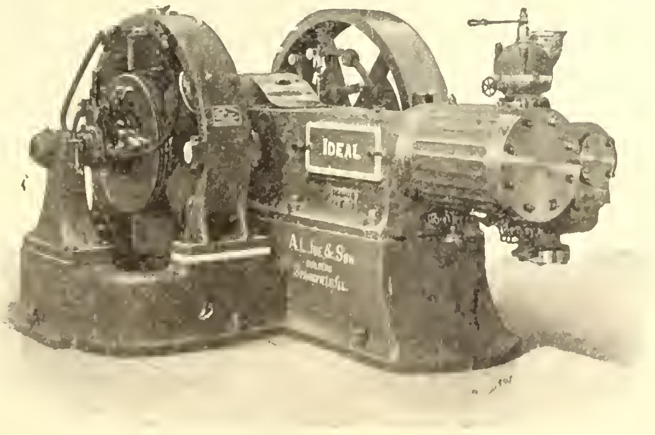

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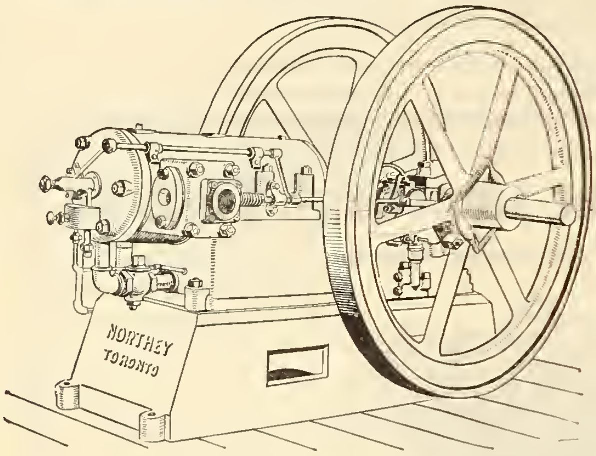

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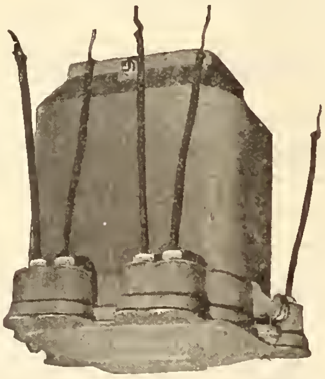

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A MAMMOTH LEATHER BELT.

THE illustration on this page represents the largest leather belt ever made in Canada. It was manufactured by Messrs. Sadler & Haworth, of Montreal and Toronto, for the Ogilvie Milling Company, of Winnipeg, Man. Its dimensions are : Width, 72 inches ; length, 115 feet ; thickness, 3 ply ; while its total weight is 2,270 lbs. The same firm recently furnished two 48 inch 3 ply belts for the Standard Electric Company of Montreal, a 38 inch belt for the London Electric Light Company, and several wide 3 ply belts for saw mills.

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GAS DRIVEN ELECTRIC PLANT.

AN interesting feature of the public service of Zurich and the neighborhood is the power plant at Oerliken, which furnishes current for the street railway lines. The installation at present includes one gas generator of 200 horse power and two of 100 hundred horse power. The generators burn anthracite from the Liege district. The gas is washed and passes through coke scrubbers and saw-dust. No smell of tar is noticed, and no trouble seems to arise in the engines, which, like the generators, come from the Maschinenfabrik Deutz. The three engines of 125 horse-power drive, each, a compound four-pole continuous current generator for 550 volts at 180 revolutions. A battery of 280 Tudor cells is connected in parallel to the dynamos. Tne regulating cells are changed by a motor-generator.

The guide book furnishes the following information regarding this station, which belongs to the Zurich Oerliken-Seebach system : Coal consumed per effective horse power of the gas engines, 0.65 kilogramme (1.4 lb.) ; each train makes 161 kilometers (100 miles) per day ; the line having a length of 5 miles and a rolling stock of 20 cars, of which, as a rule, only 10 are running. With 3.2 passengres per car-kilometer, the income is 43 centimes per car-kilometer, and the cost amounts to 34.4 centimes.

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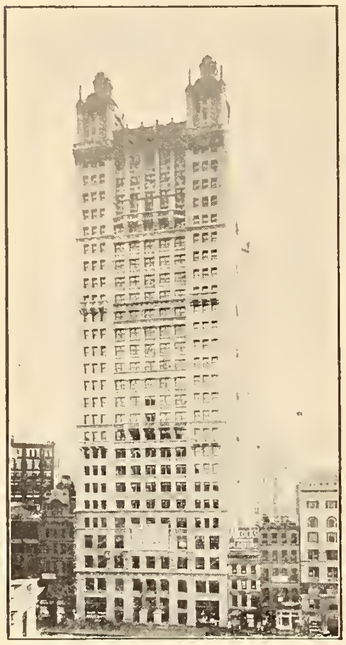


Fig. 1—Exterior of Park Row Office Building, New York City.

Among the forest of lofty structures upon the lower end of Manhattan Island, the Park Row Syndicate Building stands out prominently. This mammoth office building is opposite the New York post office, and adjoins the city hall square, and marks an important centre of the city. The construction of this building, which has recently been completed, offers to the engineer, architect, and builder many points of interest. The most modern developments of art and science in each branch of work have been applied to the equipment, and characterize this building as an advance upon previous structures. The first illustration gives an idea of the number of stories and the consequent immense number of persons to be accommodated and transported. The building is somewhat irregular in plan, having a frontage of 104 feet on Park Row, and extends backward a distance of 178 feet. There are 26 stories from the ground level to the main roof, five stories in each tower, and one small story in each dome. In addition, there is a basement and sub-cellar below ground, making a total of 34 stories in all. The height of the building is 424 feet. Pile foundations are used throughout, the total weight of the building being computed at about 65,000 tons.

The building contains nearly 1,000 offices, each of which is finished in hard wood, is steam heated, electric lighted, and supplied with hot and cold water. All the offices are connected by telephones, with an information bureau at the entrance to the building, and have a messenger call box. It is estimated that the building has accommodation for 4,000 persons, and will contain this number when all the offices are let.

The Westinghouse Electric & Manufacturing Company supplied the electrical equipment, including the generators, boosters and switchboard, an account of which will be given in this article. The other branches of construction were designed and carried out so that the building should be second to none in point of equipment. The boiler room is in the center of the sub-cellar, east of the generating plant, and contains three water tube boilers, aggregating 900 h.p. The main steam pipes are designed to carry a continuous working pressure of 130 pounds to the square inch. Each boiler is provided with separators to insure the delivery of dry steam to the engines. Exhaust fans, operated by electric motors, retain the temperature of the boiler and engine rooms at a low point. From the boiler room steam is taken to heat the system of offices. In zero weather 70 degrees will be maintained by direct low pressure, or exhaust steam radiators, operated by a 16 inch main in the basement. This main is cross-connected with the exhaust from the engine and pumps. The condensation from the heating system is returned to the boilers by pumps.

In the sub-basement the three boilers are installed near the centre, between the columns. The engine and generator room is partitioned off, and in front of these, running under the pavement, is a part used for the storage battery. Coal is brought to the building through an alley and shot into the bunkers. Along one side of the sub-basement a railway track is built for conveying coal from the storage rooms to the boilers, and for carrying ashes to the sidewalk lifts in front of the building.

The engine and generator room contains five steam engines, direct connected to Westinghouse generators. Four of the engines are tandem compound. They are operated as non-condensing compound engines. It is expected that with a steam pressure of 130 pounds they will show a much better steam economy than simple engines. The fifth engine has a single cylinder, and operates a booster in connection with the storage battery.

The electric generating plant was provided by the Westinghouse Electric & Manufacturing Company, and consists of two 200 k.w., one 100 k.w., and one 75 k.w. Westinghouse standard, compound wound generators, 120 volts. Fig. 2 shows one of the 200 k.w. generators. The additional apparatus is the 40 k.w. booster dynamo, direct connected to the smaller engine, and a 20 k.w. booster driven by a 32 h.p. electric motor. Fig. 3 illustrates the booster attached to the electric motor.

In addition to the generating plant, a storage battery has been provided, of 58 chloride accumulators. The battery insures an equalization of load, and acts as a reservoir of electrical energy for supplementing the plant in case of necessity. It also supplies current for a few lights and an elevator service for night duty. The capacity of the cells in the battery is 500 k.w. hours, and the normal discharge rate is 350 amperes for ten hours, but it is capable of discharging at five times this rate, and a momentary discharge of 2,000 amperes for periods not exceeding thirty seconds.

The booster dynamos are operated in connection with the storage battery to compensate and equalize the load fluctuations and to maintain the output of the dynamos relatively constant. The two boosters are interchangeable, to serve for varying outputs, and the dynamo portions are substantially alike. The field of the dynamo portion in both cases has a series and shunt winding, the two connected differentially. Both windings can be varied, the shunt winding being varied by a rheostat in the usual way, while the series winding is varied by a series of equalizer shunts.

The series winding of the booster dynamo is arranged so as to take either the whole or a determinate portion of the current fed from the dynamos into the power circuits, and this winding, and the e.m.f. due to it, are made responsive thereby to the conditions and fluctuations of the load on the power circuits. The shunt windings are connected across the terminals of the battery or excited from the dynamo bus-bars. The armature of the booster dynamo is connected to the battery circuit. By making the proper adjustments so as to regulate the relative effects of the series and shunt windings according to the conditions of load, the condition of the charge of the storage battery, and the regulating effect desired, etc., it is possible to arrange the conditions so that for a certain critical current the battery e.m.f. will exactly equal that at the bus-bars. For a higher current the booster dynamo will act as a generator to supplement the e.m.f. of the battery, and make it discharge in parallel with the generators. If the working current falls below the critical value, the effect of the shunt winding predominates, and the booster dynamo will generate an e.m.f. in the opposite direction to supplement the charging effect of the generators. It is seen, therefore, that

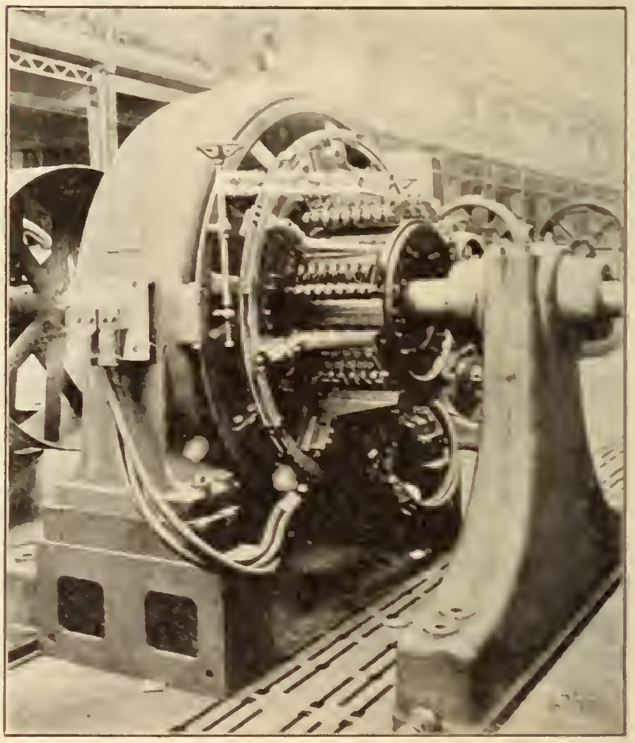


Fig. 2—One of the Two 200 k.w. Westinghouse Direct Current, "Engine Type" Generators.—Park Row Office Building, New York City.

when the load increases above the amount for which the adjustments have been made, the booster dynamo will regulate the action of the storage battery so as to make it assist the generators in supplying current, and when the power load becomes light or falls off, the booster will assist the generators in charging the battery.

The critical current admits of a wide range of regulation according to the load curve, the number of generator units that are in operation, and the condition of the battery, that is to say, whether it is empty or filled, and the rate of charge or discharge which it is desired to maintain. It is intended to keep the battery constantly charged, which can be done by adjusting the relative shunt and series fields. The regulating or compensating action can be obtained with the same ease and precision when the adjustments are such that the battery takes in more than it gives, or is gaining in charge, or when it gives out more than it takes, or is losing in charge.

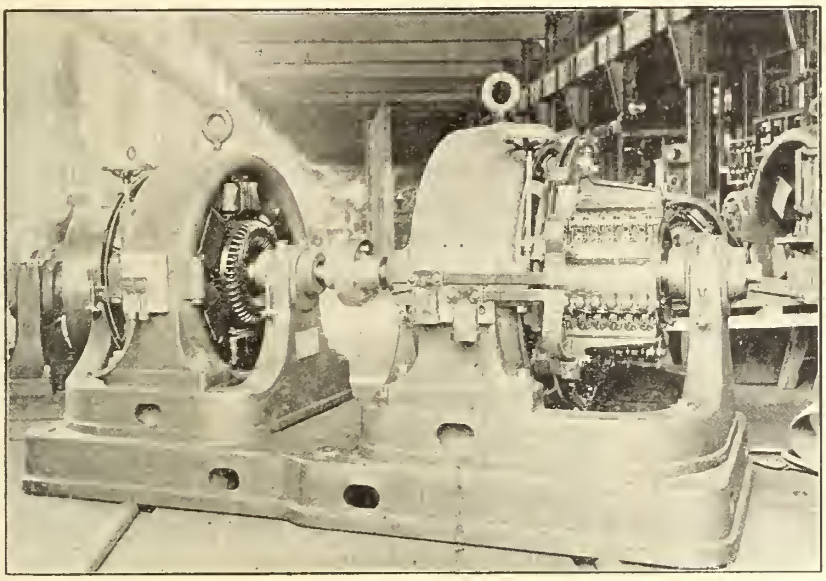


FIG. 3—WESTINGHOUSE 20 K.W. MOTOR DRIVEN BOOSTER.—PARK ROW OFFICE BUILDING, NEW YORK CITY.

Recording instruments upon the switchboard show the amount of the charging and discharging, and the station operator is kept advised at all times as to the condition of the storage battery. Current for lighting purposes is taken from the machines beyond the compounding, and the power in connection with the booster and storage battery is taken off within the compounding, by special devices, permitting the compounding effect of the battery to be varied.

The switchboard, shown in Fig. 4, was designed and built by the Westinghouse Electric & Manufacturing Company, from specifications by the electrical engineer. It is in many respects unique, not only in completeness of the appliances, and the facilities which it affords for controlling the operation of the generating plant, but in the thoroughness of the engineering design and workmanship bestowed upon it. It is arranged to control the output of the four 125 volt generators, also for one motor-driven, and one steam-driven booster, and the current from the storage battery. The switchboard has three main divisions. The centre panel serves for the electrica manipulation of all circuits from the main dynamos, booster dynamos, and the storage battery, constituting the electrical generating plant. The right panel serves for lighting feeders only and the left panel for power feeders only. The three panels are side by side, forming one continuous switchboard.

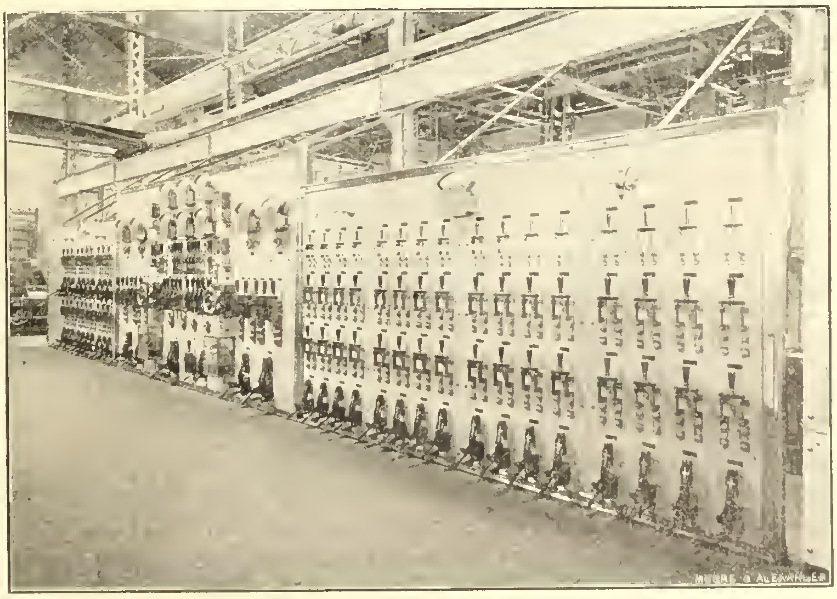


FIG. 4—WESTINGHOUSE SWITCHBOARD, FRONT VIEW. PARK ROW OFFICE BUILDING, NEW YORK CITY.

Each generator is provided in its negative circuit with a single pole fused switch—circuit breaker and an ammeter, while the positive and equalizer circuits pass through a double pole switch, the positive circuit only being fused. One of the 200 k.w. and the 100 k.w. Westinghouse generators are connected to run in multiple, on a separate section of bus-bars at the left end of the dynamo panel facing the front, while the other 200 k.w. generator runs in multiple with the 75 k.w. on a similar section of bus-bars at the right hand end. The boosters, booster motor, and storage battery are connected through their switches to the central section of bus-bars. The central section may be thrown in multiple with either or both of the dynamo sections by means of the heavy three-pole bus-junction switches. If these are left open, the right and left sections of the dynamo panel will be entirely disconnected from the middle section, and the units corresponding to said panels will operate as if they belonged to distinct generating stations, one serving for the lighting current supply and the other for the power current supply. By closing the left "bus-junction switch," the storage battery plant may be coupled, so to speak, to the power side. By closing the right switch it may be coupled to the lighting side, and lastly, by closing both swithes, the two power plants become coupled together in one single generating plant, including the storage battery. This may also be thrown on the bus-bars independently, and the whole generating plant shut down in case of light load, the battery supplying all the necessary current.

The power and lighting sections are each provided with an ammeter, a recording wattmeter and a recording ammeter, for measuring the total current. The lighting section has provision for 48 feeders, 16 of these being 100 amperes and 32 being 200 amperes capacity. They are all provided with double pole fused switches, and 16 of the 200 ampere circuits have circuit breakers in addition. The power section provides for ten 300 ampere and ten 500 ampere circuits, each circuit being supplied with a fused switch and a circuit breaker.

The current from the storage battery is measured by a double reading ammeter, a double reading recording ammeter, and a recording wattmeter, this circuit being also provided with a 500 ampere switch and circuit breaker.

The dynamo panel carries a ground detector, a recording voltmeter, a differential galvanometer, and a main station voltmeter, each being provided with suitable multipoint switches for connections to the various circuits. There are also ammeters for each booster circuit, and switches for manipulating the boosters and starting the booster motors. All the rheostats are operated by hand-wheels placed on the front of the board.

The board is constructed of the best Tennessee marble of uniform coloring, the separate slabs being joined together by accurately squared edges, presenting the appearance of three arge panels. A rigid angle and channel iron frame supports the entire board, the whole being carried on iron pedestals, which raise it six inches above the floor. The total length is 42 feet.

The power section at the left end of the switch-board is provided with a marble door, in order that the rear of the board may be conveniently reached from the engine room. The length of the power section is 12 feet, and the height 8 feet above the floor. The length of the dynamo section is 16 feet and the height 9 feet 3 inches. The length of the lighting section is 14 feet, and the height 9 feet 3 inches. An ornamental moulding of bright copper frames each section, and all the instruments, hand-wheels, double goose-necks, instrument cases, and metal trimmings are finished in bright copper. A neat grill work fills the space between the switch-board and ceiling, and hides the pedestals below the board.

Copper-finished engraved name-plates are provided for all instruments and switches, to designate the circuit each operates. All the bus bars and rear connections of the rear of the board are made of the best lake copper, the connections being secured to instrument studs by means of heavy copper nuts screwed on the studs. On account of the complicated nature of the connections the rear of the board presents a perfect network of copper, but the parts are well supported. The individual bars are carefully spaced and symmetrically arranged, and present a very neat appearance, the whole being an excellent piece of switchboard engineering. Indeed, to the careful visiting engineer, the front of the switchboard, handsome as it is, is not as attractive or interesting as the constructive details at the back of it.

The cables for the dynamo leads pass from the board directly into conduits. The feeders for lighting and power rise from the rear of the feeder panels to the ceiling of the dynamo room in conduits. Every part of the board is designed to carry its rated current without appreciable rise in temperature above the surrounding air. The circuit breakers are of a new and novel design, having laminated copper blades, closed with a toggle joint. They break the circuit at the carbon shunts supplied at the top. All the switches are of the unit blade variety. A single unit blade of definite capacity is used. One or two blades are combined in multiple to make up switches of required capacity. All switches are built of the best lake copper, no castings being used in their construction.

The switches and circuit breakers are finished by hand with a good tool finish. The main bus junction switches are of the screw press type, and are 3-pole in order to connect together the positive, negative andequalizer sections of the bus bars. They are constructed on the unit blade principle, each blade being composed of three 1,000 ampere units in multiple, each with its independent set of jaws. The blades move in and out of their jaws by turning a crank handle attached to the hand wheel, and are kept in alignment by suitable suitable guides. The capacity of each of these switches is 3,000 amperes.

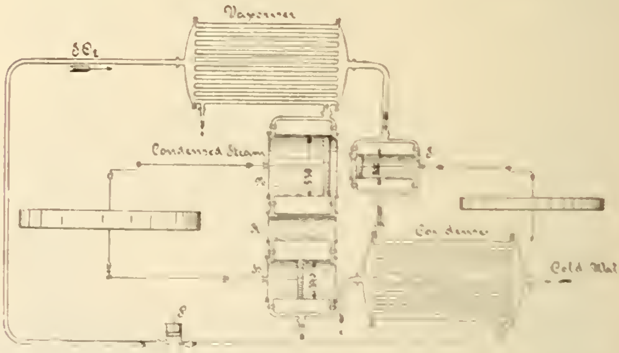
The shunt resistances for varying the compounding of the boosters are constructed of grids ot special resistance metal. They are supported on the rear of the board, near the top, and are suitably connected to the various switches by hard rolled copper bars.

INCREASING THE EFFICIENCY OF STEAM ENGINES.

The recent centennial anniversary of the Royal Technical High School at Charlottenburg was made the occasion of several important announcements concerning the work of that renowned institution, which embodies in a remarkable degree the advanced technical science which has done so much to push Germany forward into the front rank of manufacturing nations. Among these, the first rank is, by common consent, accorded to the paper of Professor E. Josse, head of the mechanical laboratory, in which are described with elaborate detail the results of his experiments with an original and highly interesting process for increasing the efficiency of steam engines by utilizing the heat of the exhaust steam for evaporating another liquid having a lower boiling point than water.

It is well known that the steam boiler and engine, notwithstanding all improvements which it has undergone during the past 100 years, and its incalculable services to mankind, is nevertheless a wasteful and extravagant device for converting the energy stored in fuel into mechanical power. The ordinary simple, high-pressure engine, which, after passing steam through one cylinder, discharges it into the air, utilizes hardly more than five per cent. of the value of the fuel consumed under its boiler. The compound engine, in which the steam, after passing successively through two, three or more cylinders, is condensed, and the warm water of condensation restored to the boiler, utilizes, under favorable conditions, 12 to 13 per cent. of the fuel energy, and there the economy appears to have stopped. An eminent American engineer has recently published an article reviewing the development of the steam engine, and closes his essay with the expressed opinion that with the compound machines and improved cut-off of recent years, the practical limit of efficiency of the steam engine has been reached. The invention described by Professor Josse introduces a novel element into the problem and opens a new chapter in the record ot steam-engine development.

The process is the joint discovery of Mr. G. Behrend, a Hamburg engineer, and Dr. Zimmermann, of Ludwigshafen; and, although first patented in 1889, it has only recently been matured and its application perfected by the employment of an auxiliary engine, which, utilizing the heat contained in the exhaust steam, gains as high as 56 per cent. additional motive power without increasing the expenditure of fuel. The principle and process involved are simple, and may be briefly described as follows:



APPARATUS FOR INCREASING THE EFFICIENCY OF STEAM ENGINES.

It is plain that, with all progress which has hitherto been made in steam-engine practice through higher pressures, superheated steam, economical cut-offs or successive cylinders, there is always an important an inevitable loss of heat energy when the steam, having done its work, is discharged into the open air, or changed back to water by contact with cold water in a condenser. When the exhaust is into the open air, the steam has a temperature of about 100° Celsius (212° Fahrenheit); when it passes into condenser, the steam has a temperature of 60° to 70° Celsius (140° to 160° Fahrenheit), according to the vacuum. The corresponding latent heat of steam, given up upon change of form from steam to hot water, has hitherto run to waste in the condensing or cooling water, or in the air. Messr. Behrend and Zimmermann attacked the problem of utilizing this wasted caloric by employing it to create a new supply of steam by evaporating some liquid which has a lower boiling point than water, and for this purpose they chose after many experiments, sulphurous acid (H_2SO_3), which is not only cheap and easily obtained, but has the further advantage of a viscous consistency and lubricates the inner working surfaces of the machinery without corroding them. Their demonstrations, although not practically conclusive, were so promising that Professor Josse, as a technical authority on this subject, took up the problem, and after several months of highly satisfactory laboratory experiment, caused to be constructed and connected with an ordinary working steam engine of the compound type an additional condenser and auxiliary engine, the power of which could be exactly measured.

Referring to the diagram in which dimensions are given in millimeters,(H) and (N) represent the high and low pressure cylinders of an ordinary compound steam engine, with a stroke of 500 millimeters, (19.69 inches) and a speed of 41.5 revolutions per minute. From the low pressure cylinder (N) the exhaust steam passes into the surface condenser called in the diagram the "vaporizer." In this vaporizer or condenser, the cooling medium used, instead of water, is liquid sulphurous acid (H_2SO_3) which has a boiling point so low that it is immediately decomposed by the heat of the exhaust steam, whereby the sulphur dioxide gas (SO_2) is liberated, which passes over into the cylinder of the auxiliary engine (S), where its work is done, as in an ordinary steam engine. The auxiliary cylinder has a diameter of 300 millimeters (11.81 inches) and a stroke of 500 millimeters, with a speed of 77 revolutions per minute.

After passing through this cylinder, the sulphurous vapor enters the surface condenser, around the tubes of which cold water flows, as in an ordinary steam plant. Here the sulphurous vapor is condensed to liquid and is forced by pump (P) back into the vaporizer, where it begins its cycle again, the same (SO_2) being used over and over again indefinitely. There are, therefore, in fact, two condensers, the first serving, as it were, as boiler or steam generator for the auxiliary engine ; and this boiler instead of being fired by coal, obtains all its heat from the exhaust of an ordinary steam engine, and, instead of converting water into steam, evaporates a liquid which is much more volatile, i.e., has a far lower boiling point.

In the long series of recorded tests with the plant employed, the following results were attained :

The steam engine is of the compound type, of good, modern construction, and being given a steady load, developed 34 indicated horsepower, with a consumption of 8.6 kilogrammes (18.96 pounds) of steam per incated horsepower-hour. The auxiliary machine working with the sulphurous vapor indicated 19 horsepower, that is, an increase of 56 per cent. and yielding, instead of one horsepower, 1.56 horsepower for the same steam consumption, and reducing the steam consumption from 8.6 kilogrammes to 5.5 kilogrammes (from 18.96 to 12.13 pounds) per indicated horsepower.

The experiments showed on the average that for every 15 kilogrammes (33,169 pounds) of steam passing through the main engine, one h.p. could be gained in the auxiliary machine. Applied, therefore, to an ordinary single-cylinder steam engine, exhausting into the air at high temperature, the percentage of power saved by this new device would be very much higher than the economy reached in these experiments, which as has been shown, were made with a highly improved compound engine. From the average of these experiments, it may be broadly stated that, given a fairly economical compound engine, using 7½ kilogrammes (16.5 pounds) of steam per indicated horsepower-hour, half an indicated horsepower could be produced in the auxiliary machine for every indicated horsepower developed in the main engine. Assuming an average vacuum of 60 centimeters (23.62 inches, corresponding to a temperature of 60° Celsius (140° Fahrenheit), the saving of heat must be accomplished by using a liquid which can be vaporized to a high pressure at or below that temperature. Assuming further, the upper and lower limits of temperature within which the operation is confined to be 60° and 20° Celsius (140° and 67° Fahrenheit), the pressure of the sulphurous vapor would range from 10.05 down to 2.35 atmospheres above open-air pressure. A working pressure as high as ordinary steam-boiler pressure is, therefore, readily obtained at a comparatively moderate temperature. Moreover, the volume of sulphurous-acid vapor necessary to contain the number of heat units corresponding to the work to be performed is much smaller than the volume of steam which would be required for the same purpose. As the saving to be effected by the auxiliary engine depends directly upon the difference between the highest and lowest temperatures involved, the greatest gain will, therefore, be made either when the water in the surface condenser is as cold as possible, or when the heat of the exhaust steam from the engine is at a maximum, as is the case with a single-cylinder steam engine without condenser, which may be anywhere up to 212° Fahrenheit.

The expense of this improvement is practically all in the construction cost of the vaporizer, condenser and auxiliary engine itself, and its economy may be realized from the fact that the exhaust steam from a 2,000 h.p. central station engine should furnish power to drive an additional 1,000 h.p. engine, which can be connected as an extra cylinder to the steam engine or run independently, and thus increase by 50 per cent. the power developed without adding a pound to the quantity of fuel consumed. When, in view of the present coal famine throughout Europe, it is remembered that the steam-engine energy of Germany alone, afloat and ashore, is not less than 3,717,264 h.p., the commercial importance of such an improvement will be readily apparent.

ALUMINUM AS A CONDUCTOR.

The Chicago Record says that aluminum is to have its first important trial as a commercial conductor of electricity on the Northwestern Elevated Road. Twenty miles of inch and a half cables—150,000 pounds of the light-weight, silvery stuff—are to be strung along the steel trestle to distribute the motive power to the trolley rails of the new road. Aluminum displaces its copper rival on the new road because of its cheapness. Copper has almost doubled in price within a twelvemonth while the lighter metal has dropped a shade in the scale. James R. Chapman, the electrical engineer in charge of the new road, says : "After copper, aluminum is the best conductor among the cheaper metals. An aluminum wire has the additional advantages of being lighter to handle and of being non-corrosive." According to Mr. Chapman, a perfect joint has been made possible by a solder invented by a Chicago man.

Beginning with the January number, the publishers of Science Abstracts, of London, England, introduced a chapter on "Steam Plant, Gas and Oil Engines," also abstracts dealing with motor cars in general.

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Correspondence is invited upon all topics legitimately coming within the scope of this journal

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REMOVAL NOTICE.

On May 1st next the Montreal office of The CANADIAN ELECTRICAL NEWS will be removed from the New York Life Building to the Imperial Building, corner St. James Street and Place d'Armes Hill.

Underground Conduits.

IN the larger cities of Canada the advantages of underground conduits for electric wires are gradually being recognized by the electrical companies. The Lachine Rapids Hydrulic & Land Company have placed their wires underground along many of the principal streets in Montreal, and it is observed by the report of the directors that the system has been found eminently satisfactory. The Montreal Street Railway Company are about to take similar action. Apart from enhancing the appearance of a city by the removal of unsightly poles, we believe that the underground system will be found to have many advantages for the electrical companies as compared with the present overhead construction, at least in the congested business sections in cities. While the first cost of installation will be heavy, this will in time be overbalanced by the comparative freedom from accidents, interruption from sleet storms, etc.

The Use of Storage Batteries in Central Stations.

THE history of the storage battery on the American continent has been a curious one, and illustrates the difference in methods and conditions existing between American and European practice. While on the continent the storage battery was recognized as an almost essential part of the station equipment, and in England its value was largely conceded ; in America until 1894 the records show that the installations using a battery plant were few and far between and generally far from successful. The larger use of batteries in Europe is due to several causes, chief among them being the fact that by far the larger number of stations existing there are of the direct current order, while on this side the alternating stations preponderate. In addition to this it appears that until 1894 the storage field was being exploited in America by a number of weak companies, among whom considerable rivalry existed tending towards the practice of obtaining business by any method at hand, working for immediate returns only, and litigating in the patent courts. The results were that the storage battery was applied in many cases where its use was not justified, and the proper precautions were not taken to ensure that the equipment was large and substantial enough to stand the severe operative conditions imposed by heavy discharges. In Europe, on the other hand, proper engineering methods prevailed, in consequence of which we find successful installation from the first. Since that time, however, a consolidation of interests has taken place in America, and the trade is largely in the hands of one powerful company, with the result that since 1894 the sales of batteries have increased almost twelve fold. This tremendous increase is due to the fact that the larger stations in the American cities have recognized the usefulness of the storage system and applied it not only to the lighting demands, but latterly and very extensively to the needs of street railway systems.

The improvement which has taken place in the operation of the storage battery on this continent has been due not to any great advance in the direction of newer and more efficient types of cells, but to the gradual improvement of those already existing as regards their mechanical features, their more intelligent handling while in operation, and more important than any, that with proper engineering the conditions of operation have determined the type and capacity of the cells and not the mere question of first cost. These points having been given proper attention, it became evident to the larger lighting companies that the battery had a place in their equipment, and the smaller companies, although slower to recognize its value, are now more rapidly falling into line, and in Canada a careful consideration of the question will no doubt lead to the adoption of batteries in at least some of the larger steam stations. While each case must be considered upon its merits, and no general conclusions can be arrived at which will suit all cases, there are a few land marks which will serve as guides in determining the question for any particular plant.

Generally speaking, the uses to which a battery plant can be put in central station practice are as follows: First, to carry the peak of the load; second, to carry the entire minimum load for whatever time it may exist; third, to act as an equalizer or reservoir, charging and discharging as the fluctuations and variations of the load demands; fourth, to be used in sub-stations to assist the regulation over the feeders and to cut down the cost of feeder copper, which would be designed for the average load instead of the maximum. In the lighting station the first two uses are generally given first consideration, and for traction work the latter two; and in a combination station, of course, each use demands a careful investigation. The case of use for the peak of the load is usually first met with when it becomes necessary to install more apparatus to meet increased demands, and the relative merits of additional steam apparatus or battery equipment then come up for consideration. For this use in lighting stations, as the peak of the load is of short duration, the battery should be suitable for a high discharge rate for a short time, so that the cost per kilowatt available over the time under consideration should be given the first consideration and serve as a basis of comparison with the cost per kilowatt of steam plant. In the case where the battery is to be used to carry the minimum load over longer periods, say from midnight on, the kilowatt hours of capacity becomes the chief consideration, apart from its ability to be rapidly charged and discharged, and it will be found that the cost per kilowatt hour for batteries for the two cases above mentioned is vastly different. For instance, a battery for an eight hour discharge rate may cost from forty to forty-five dollars per k.w. hour, while if the discharge rate be one hour the cost will probably be nearly three times as much per k.w. hour. A point which is frequently misunderstood in dealing with rapid rate as distinguished from slow rate discharge of batteries is the efficiency. It may be stated that if an eight hour battery be discharged in one hour, its capacity in k.w. hours will probably be cut down fifty per cent., but this does not involve a corresponding decrease in efficiency, as, if the battery be recharged, the input will correspond with the amount taken out, less, of course, the inherent losses due to charging which exist in every storage cell. For this reason it becomes apparent that the cost of a rapid rate battery will be greater per k.w. hour than a slow rate battery of a similar capacity, while the efficiency should not be very different. It should also be noted that while the ampere efficiency may be 90 per cent., the watt efficiency as measured by the ratio of watt output to input will seldom be found in practice to be higher than 75 per cent., and this latter percentage should be considered, and not the former, in dealing with the relative merits of the battery and steam plant as regards its effects upon the coal consumption.

The question of depreciation is at once brought up for discussion when storage is suggested, and the battle generally ranges about that point. This is hardly to be wondered at when it is considered that the purchaser has before him the very unfavourable records of past years; and he is justified in assuming that modern installations have not been in existence long enough to demonstrate that the depreciation factor has been reduced to a commercial point by proper engineering of the plant and mechanical construction of the cells, as is claimed. The chief causes of battery failure are buckling, short circuiting, sulphating, disintegrating, and dropping of active materials, and it is safe to say that at least fifty per cent. of the depreciation accounts have been due to improper charging and discharging and general lack of attention given the cells while in the customers' hands. This is not due to the fact that the battery requires any great amount of attention, but for the reason that the action being chemical, troubles do not manifest themselves as in mechanical apparatus, and the battery which is being rapidly worn out appears upon casual inspection to be in fair condition. A proper recognition of these facts has contributed to cut down the depreciation allowed very largely. This matter of depreciation has forced many companies manufacturing batteries to guarantee this charge; and in America several large plants for severe work have been guaranteed at the rate of seven to eight per cent., while in Germany, where the experience has been more extensive, the manufacturing companies will maintain the cells for 4 per cent. of the cost per year under fair operative conditions; and many of the owners will not avail themselves of the offer, as they claim that they can maintain their equipments for less than that percentage. From these considerations it appears that, in figuring upon the depreciation and repair account of storage equipment, properly designed for the existing conditions of operation and properly inspected and handled, this portion of the plant may safely be treated as being subject to the same percentage allowance for depreciation and repairs as the mechanical portion of the station equipment. For obvious reasons the battery does not appeal to the manager operating a water power station unless the question of the load becoming greater than can be handled with the water available, becomes pressing, when the case becomes similar to that of a steam station in which the demand exceeds the capacity. In these cases it becomes a question between the use of additional steam plant and the installation of batteries. The advantage on the side of the battery is that it enables the steam plant to operate at a point nearer full load during the time of charging, and either relieves it of the peak of the load or enables the steam equipment to be shut down during certain portions of the twenty-four hours. Generally speaking, it will be be found that the cost of a battery equipment for the peak of the load will not greatly exceed, if at all, the necessary increase of steam equipment, and if it be allowed that the interest, depreciation, aud repair percentage allowance for similar investments will be about the same, the advisability of installing either depends upon the relative cost of coal and supplies and labor for the additional output. As regards the labour account, it will generally be found that the battery has the advantage, especially where it allows of the steam equipment being shut down for a sufficient number of hours to permit of a reduction of the shift. As regards the coal consumption, the losses in the battery must be placed against the losses in the rival steam equipment, making also due allowance for the saving in coal per kilowatt output of the original plant while charging the batteries, due to the fact that the engines are running under greater load and therefore at a more economical point. In figuring the loss in the batteries, it must be carefully kept in mind that this loss only exists while the battery is in use and should not be figured as an all loss loss against the equipment.

The above considerations, while applying more properly to the use of batteries in lighting stations, are also generally applicable to their use for railway operating, although for this class of work the ability of the battery to absorb fluctuations in the loads becomes the prominent feature. This application is being taken advantage of more and more by the larger street railway companies, and even in such cases as Pittsburg, where coal costs only about 45 cents per ton, storage is in use to prevent fluctuations and to minimize sudden strains on the machinery. Even although the battery under certain conditions may not appeal to the station management, the customer may find it of advantage, as is illustrated by the use of batteries by the Buffalo Traction Company, which receives its power from Niagara, stores it during light load hours, and uses it to cut down the peak of the load, thus dispensing with the use of much mechanical apparatus and effecting a saving in the cost of power taken. It may be pointed out that in the larger cities where the power demands are of the best the average yearly output of the stations are usually under 40 per cent. of the capabilities of the steam machinery which must be installed to take the peak of the load in the winter, so that the operating companies have at least 60 per cent. of their available output locked up unless batteries are used, and the extra cost of production of this extra output would only be the cost of the additional coal, and could be very cheaply sold, and it is this power which is rendered available by the battery.

THE CANADIAN ELECTRICAL ASSOCIATION.

Arrangements are progressing favorably for the annual convention of the Canadian Electrical Association, to be held in the city of Ottawa on the 27th, 28th and 29th of June. The committee appointed to arrange for papers have met with encouraging success, having secured the promise of certain papers from several persons prominent in the electrical industry. The local committee will meet at an early date to make preparations for the event, and we understand that every effort is being put forth to interest members and outsiders everywhere with a view to having a large attendance and profitable meeting, and with favorable weather the convention should be a great success. In next issue some particulars of the programme may be given.

Mr. Thomas Hawkins, well known in street railway circles in Montreal and St. John, N.B., left recently for Georgetown, Demarara, where he will superintend the installation of an electric plant. Mr. F. Brothers will leave shortly for the same place, he having been given the superintendence of the construction of an electric railway in which a number of Montreal capitalists are interested.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, April 2nd, 1900.

The Alien Labor Law keeps electrical wiring contractors of this country from going into the neighboring republic to secure contracts, yet their contractors can come in here, or rather send a representative, to take off quantities, figure on Canadian jobs at Canadian archtiects' offices, and there is no one to say to them "nay"; surely this is not just.

Dame Malvina Heve, widow of the late Alphonse Girouard, hotel-keeper, of Ste. Cunegonde, who was killed by an electric shock while in the act of lighting an electric lamp in his premises, is suing the Royal Electric Company for $15,000 damages. Some interesting evidence may be expected.

Spring business in the electrical contracting line looks good in this city. There are quite a number of architects soliciting tenders for wiring, one of the most notable being the combined hotel and station for the Canadian Pacific Railway Company, to be built at Winnipeg. This building is in the hands of Mr. E. Maxwell, architect.

The bad roads after the heavy snowfalls lately have made an increased demand on the Montreal Street Railway Company, so that each Windsor car resembles a box of sardines, in that humanity is packed to the greatest extent. In expiation, however, it is just possible that the high cost of iron, copper and similar necessities may be causing the management to await a more favorable time for buying, so as to increase the copper, power units and construction work. "Speed the time."

The Montreal Daily Star (Graham & Co.) intend installing considerable wiring for both lights and motors in their new building. Tenders are now being called for by the architect, Mr. A. F. Dunlop. It is stated that a United States expert was called in to draw up the specifications, which are certainly elaborate, but quite capable of having been drawn up by local consulting electrical engineers—in fact bettered.

It is now evident that the Montreal Street Railway Company will put certain feeders underground. In fact, it is also rumored that the Royal Electric Company are figuring on similar action. As the Lachine Rapids Company and Bell Telephone Company have both already made a start in this direction, the date when our "picket fence" (as a United States gentleman described the rows of poles) will be removed, may soon be in sight. Of course, no one at all acquainted with the business imagines that each and every pole will be dispensed with. A few must remain.

The heavy snow fall in this city about March 1st, simply knocked the Montreal street railway off its feet, after a gallant fight had been put up. They were not long in getting into running order again, however, and even the time of stoppage could have been materially reduced had the city been a little more prompt in carting the snow off the streets.

No troubles seem to have occurred with either the Royal or Lachine Rapids Companys circuits during the winter blizzards.

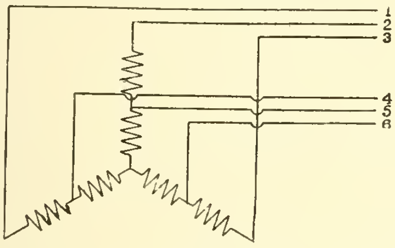
Quebec city seems to have caught it lively during the snow fall. It is reported that the street railway had some dozen or more cars, half a dozen sweepers, etc., stalled in the snow for about 24 hours.

The Jacques Cartier Water and Power Co. at Quebec are making some "fine cut" quotations in their fight for business against the existing Montmorency Company. One cent per lamp per night, less 10% for cash, is a sample of "some flat-rates."

The Power Publishing Company, World Building, New York, have favored us with a copy of a new work entitled, "Electric Wiring," by Cecil P. Poole. A perusal of this book proves it to be very interesting and valuable. It is designed to serve both as an instructor for practical wiremen who have occasion to lay out their own work, and as a convenience and general reference book for electrical engineers whose work includes the calculation of transmission circuits, etc. Reference tables and formulas are presented in convenient form. But perhaps the most valuable features of the work are the wiring tables for alternating current motors and the tables showing the corrected drop in inductive circuits. These are the only tables of the kind which have come to our notice. The price of the book is $1.00.

A SIMPLE TWO-PHASE SYSTEM OF SECONDARY MAINS.

On the distributing network of the Hartford Electric Light Company, there is in use a simple means of distributing with a minimum number of wires the two-phase currents for both lights and motors. The secondary mains are three-wire for lighting and two-phase for power, largely underground and supplied in districts by manhole transformers. Each manhole has two transformers, one for each phase ; each transformer being tapped out at its central point for the neutral of the three-wire 220-volt network. The secondaries of the two transformers are shown at A and B in the accompanying diagram of connections. One outside terminal of A is connected to one outside terminal of B, and in each direction four wires are carried. It will be noticed that to the right the upper three wires are those of the three-wire single-phase circuit from transformer A, and the lower wire coming from transformer B, with the wire next above it, gives a pressure of 220 volts of the other phase to motors in that direction. The neutral of transformer A is not carried to the left, while that of transformer B is, and all lights in this direction are supplied from the three-wire system of the latter transformer, while in this direction also one wire serves commonly as one outer of the three-wire system and as one side of the secondary of the other phase. Thus four wires serve to give a three-wire lighting and a two-phase motor distribution and the lights are approximately equally divided between the two phases. The neutrals are, of course, not connected in to the motors, which run at 220 volts on each phase and are wired on the two-phase three-wire principle. It is obvious that there is between the upper and the lower wires going out in each direction an electromotive force consisting of the vectorial resultant of the two 220 volts which amounts to about 310 volts, but this increased pressure is no particular disadvantage on low-tension circuits. It is also obvious that the wire used commonly by both phases gets an increased current, but not sufficiently so to materially affect the regulation. The system has proven perfectly satisfactory.—American Electrician.



The Connections of Secondary Networks for the Distribution of Two-Phase Power and Three-Wire Lighting on Four Wires.

INCREASED SCALE IN BOILERS IN DRY WEATHER.

Probably very few steam users have ever noticed that the formation of scale in boilers is much more rapid and troublesome in times of protracted drought than in times when the streams from which the feed water is taken are full; yet this is a fact well established by the reports of boiler inspectors, and should be taken into account by steam users whose feed water is from streams fed mostly by surface water from rainfall. The Locomotive, published by the Hartford Steam Boiler Inspection and Insurance Company, explains the increase of scale by dry weather. The reason for this, according to our contemporary, is not hard to find, the unusual deposits of scale being due to the increased hardness of the water after a lengthy spell of dry weather. In times of drought the water is drawn necessarily from the lower levels, in reaching which it has become impregnated with lime, magnesia, and other soluble substances contained in the overlying strata. In a season of copious rainfall, on the other hand, the ground, being soaked, cannot absorb the surface water, which rapidly drains off into rivers or reservoirs, as the case may be, before it has had time to dissolve out the scale-forming substances in any quantity. In a season of light rainfall the ground can absorb practically all the water that falls, and the proportion of surface water is relatively small. Hence in dry seasons the water used in the boilers will be largely spring or hard water, and in wet seasons it will consist chiefly of surface or soft water, the deposits of boiler scale being larger or smaller in proportion. The moral of all this is two-fold. In the first place, during a dry season boilers should be more frequently opened, examined, and cleaned. Just how much oftener this should be done must depend upon local conditions and the severity of the drought ; but it is suggested that, judging from observations made in the State of Connecticut, they should be inspected in such a season as the last about twice as frequently. Another fact to be remembered is that when a heavy rainfall comes, bringing a sudden supply of surface—and, therefore, soft—water, the scale that is in the boiler will be suddenly loosened up, and unless precautions are taken it will lodge over the fire sheet and cause trouble. This is particularly liable to happen during the melting of the snow in the spring, when the water will be particularly free from mineral salts.

THE CENTRAL ONTARIO POWER COMPANY.

At a recent meeting at the Queen's hotel, Toronto, of the shareholders of the Central Ontario Power Co., Limited (proprietors of the Burleigh Falls water power), lately incorporated with a capital of $750,000, for the purpose of developing the Burleigh Falls and other water powers, and for transmitting electric power to Peterborough and Lindsay and district, and for operating a radial system of electric railways in the vicinity, the following directors were elected, viz.: Hon. Richard Harcourt, Toronto, president ; F. A. Hall, Perth, vice-president ; J. Alex. Culverwell, managing director ; Hon. Senator, Peter McLaren, Perth ; Eugene Coste, M. E., Toronto ; James Kendrey, M. P., Peterborough; R. J. McLaughlin, Lindsay ; F. W. Barrett, Edward T. Adams, M. D., Toronto ; H. J. Taylor and H. E. Larkin, St. Catharines. The company have opened their head offices at Peterborough, the managing director, Mr. J. Alex. Culverwell, late of Toronto, having removed to Peterborough to take charge of the company's offices.

PERSONAL.

Mr. W. B. Close, manager of the Toronto & Suburban Electric Railway, has tendered his resignation.

The death of Mr. George H. Betram, M. P. for Toronto, and head of the Bertram Engine Works Company, which occured on March 20th, was the cause of widespread regret. Mr. Bertram was a business man of marked ability. In 1892 the firm of Bertram & Company took over the manufacturing business of the Doty Engine Works Company, with later became the Bertram Engine Works Company, and largely identified with shipbuilding. Mr. Bertram was elected to the House of Commons in November, 1897.

Mr. W. J. Gilmour, manager of the Bell Telephone Exchange at Brockville, Ont., and superintendent of District No. 6, has been appointed Superintendent of Agencies in the Eastern Department of the Bell Telephone Company, with headquarters in Montreal. This division includes the territory east of Kingston in Ontario and the whole of the province of Quebec. Mr. Gilmour has been identified with the Bell Telephone Company for fifteen years, and his removal from Brockville will be regretted by the citizens.

Mr. P. McCullough, electrican of the Toronto Railway Company, will shortly leave for Liverpool, England, where he will assume the duties of chief electrician for the Liverpool Street Railway, which is operated by the corporation. At the present time there are but a few miles of electric railway in use, but it is proposed to install a complete system to replace the horse cars. It is a source of congratulation that Canadians are being chosen to fill such important positions.

THE PROBLEM OF ARC LIGHTING FROM A 250 VOLT SUPPLY.*

By W. B. Sayer.

In the early days of electric lighting incandescent lamps were made for low voltages, and if it was necessary to use them with a high voltage, they were occasionally put in series. When the standard voltage came to be recognized as 100 no difficulty was found with incandescent lamps, but with arc lamps the difficulty of having to run two in series was met with to a comparatively slight extent. With, however, the present 250 volt supply this trouble was found to be greatly increased.

In order to meet this demand the enclosed arc lamp was brought strongly into notice, and besides having the advantage of requiring a greater voltage, it has the additional advantage of burning about twenty times as long as the open arc lamp. As regards the voltage that an enclosed arc lamp would burn satisfactorily at, the author had seen a lamp wound to take the full 250 volts across its terminals, but the result was simply an apology for light. As far, therefore, as a 250 volt circuit was concerned, there were only two arrangements in common use—viz., two enclosed arcs in series or four or five open arc lamps in series. The economy question was discussed from the consumers' point of view, and the obvious disadvantages of having five lamps in series, and so necessarily all controlled by one switch, was pointed out.

The author then went on to describe a series of tests he had carried out at the Glasgow Corporation lamp testing department by permission of Mr. Chamen. The results obtained are given in the following table, and it might be pointed out that they do not aim at theoretical accuracy, but rather at a good general practical comparison. The comparisons were made by the ordinary grease spot method, and also by the shadow method, and the ratio of the squares of the distances between the respective lamps and the position where the grease spot became invisible or the intensity of the thrown shadows equal were taken. As regards the globe used, the open arc lamp was fitted with an opaline globe, as generally now used, and the enclosed arc lamp was fitted with two obscured globes, as is customary in practical use.

TABLE SHOWING COMPARISON BETWEEN LIGHT-GIVING POWER OF OPEN AND ENCLOSED ARC LAMPS, AND COMPARISON WITH INCANDESCENT LAMPS ALL USING THE SAME POWER AND RUNNING ON 250 VOLTS.

Type of lamp.	Open arc.	Enclosed Arc		Incandescents (new clear globes)			
How arranged......	5 in series	2 in series	Single	16 of 16 c.p.		31 of 8 c.p.	
Steadying resistance	4 ohms	12 ohms	..	....		....	
Current............	10 amps.	4 amps.	2·75 amp	4·4 amps		4·48 amps.	
Watts per lamp	500	500	680	1100	500	1120	500
Comparison	1	0·375	0.1	0·63	0·31	0·75	0.33
Comparison (taking 16 c.p. as unity)....	3·25	1·54	0·325	..	1	..	1·07

The figures in the table speak for themselves. With regard to the steadying resistance in circuit with the single enclosed arc, this was combined with the lamp itself so that without unnecessary trouble this figure was unable to be filled in. Under the heading of power taken per lamp (in the case of the arcs, and of course per cluster in the case of the incandescents), owing to a mistake in the tests when testing the incandescent lamps, too much was taken, so a second column has been added reduced in proportion to bring the amount in line with the other figures. The comparisons were made with the open arc, but in order to make them clearer they have been reduced to a basis taking a 16 c.p. lamp as unity. It will be seen that a single enclosed arc lamp is only about one-third as efficient as a 16 c.p. lamp, that when two enclosed arcs are run in series the efficiency is about one and a half times that of a 16 c.p. lamp, while an open arc lamp has about three and a quarter times the efficiency of a 16 c.p. lamp. This shows the open type arc lamp to be over 100 per cent more efficient than the enclosed type arc lamp, the latter running under its most favorable conditions.

From these figures it is clear that the enclosed arc would have no chance of being popular with the public if a single open type arc could be used under similar conditions. The objections to open type arcs are: (1) The necessity of running five lamps in series, or if less are used, of absorbing the difference by means of a resistance; (2) Owing to five lamps being in series, any unsteadiness or flickering occuring in one lamp will be shown in the others on the same circuit, so that there will be five times the amount of flickering; (3) The necessity of having all the lamps in each series of the same size, type, and current. The enclosed arc lamps have the same objections, although to a very much less extent, but in the author's opinion any advantages in this respect are far more than counter-balanced by the less amount of light obtained from them for the same expenditure of power.

The author considers that there are two remedies that can be employed to overcome the difficulty of running open arc lamps on a 250 volt circuit—viz., (1) by the use of a step-down transformer; (2) by the use an arrangement designed by the author, and which he calls a "ganger switchboard." In this arrangement a separate pair of leads is run from every individual lamp to a central position where a main switch-board is fitted. This switchboard is so arranged that any lamp can be plugged into a circuit of five. The disadvantages of this method are two in number: (1) That special telephones or other signalling arrangements have to be employed for signalling to the main board, where an attendant has to be more or less constantly stationed; (2) all the lamps in the whole installation have to be exactly of the same pattern and size, and have to take the same current, and they must all be adjusted so as to work satisfactorily one with another in any combination. This difficulty is the more important seeing that as a rule arc lamps are now adjusted in the series on which they will be run, and are then numbered and set up in the same combinations. There was no doubt in the author's mind that when the number of lamps admitted of it the step-down transformer was the best and most satisfactory solution of the difficulty. He considered that the advantages might be enumerated as follows: (1) The economy that would result in being able to use any single lamp just when and where required; (2) the advantage of not being tied down to certain fixed sizes for the lamps, but being able to use just whatever size was required or was most suitable for the position; (3) that it was possible with equal economy to have any number of lamps installed, and not necessarily a multiple of five; (4) that extra lamps could be added when and where required; (5) that the voltage of the circuit could be made exactly that which was found to be the most satisfactory for the most efficient burning of the lamps.

There were, of course, objections also to the use of a step-down transformer for this purpose—viz., (1) the first cost, and also the maintenance cost; (2) the expenditure of power necessary to drive the transformer itself. In the author's opinion, however, these disadvantages are far more than counterbalanced by the advantages enumerated above. With regard to the latter objection, the author contended that his loss should be borne by the corporation o other supplying body, by fixing the meter in the secondary circuit of the transformer.

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*Abstract of a paper read before the Institution of Electrical Engineers, Glasgow.

MOONLIGHT SCHEDULE FOR APRIL.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 7.00	A.M. 4.40	9.40
2....	" 9.00	" 4.40	7.40
3....	" 10.10	" 4.40	6.30
4....	" 11.10	" 4.40	5.30
5....	" 11.50	" 4.40	4.50
7....	A.M. 0.30	" 4.30	4.00
8....	" 1.00	" 4.30	3.30
9....	" 1.30	" 4.30	3.00
10....	" 2.00	" 4.30	2.30
11....	" 2.30	" 4.30	2.00
12....	No Light.	No Light.	....
13....	No Light.	No Light.	.....
14....	No Light.	No Light.	.....
15....	No Light.	No Light.	....
16....	P.M. 7.10	P.M. 9.40	2.30
17....	" 7.10	" 10.40	3.30
18....	" 7.10	" 11.30	4.20
19....	" 7.15	A.M. 0.30	5.15
20....	" 7.15	" 1.15	6.00
21....	" 7.15	" 2.00	6.45
22....	" 7.20	" 2.30	7.10
23....	" 7.20	" 4.10	7.50
24....	" 7.20	" 3.40	8.20
25....	" 7.20	" 4.00	8.40
26....	" 7.20	" 4.00	8.40
27....	" 72.0	" 4.00	8.40
28....	" 7.20	" 4.00	8.40
29....	" 7.30	" 4.00	8.30
30....	" 7.30	" 4.00	8.30
		Total......	152.30

Mr. John M. Dixon has been appointed chief engineer of the new municipal buildings in Toronto, he having received the highest marks in the examination.

HIGH-SPEED AUTOMATIC TELGRAPHY.

American experts have been afforded an opportunity to witness the operation of the Pollak-Virag high-speed automatic telegraph system between New York and Chicago, and study the practical application of the proposed innovation to commercial work. The invention is really a combination of telegraphy, telephony and photography—rather a complicated system, it would appear, to the average mind—yet the almost incredible speed of 150,000 words an hour can be attained, it is said, without difficulty. Of course, it would be impossible to read or record messages manually and much less send them at this rate of speed, and it is to overcome this difficulty that the telephonic and photographic features are introduced. The advantages claimed are high working speeds on the line wires with very low-voltage currents, a permanent and easily decipherable record, and automatic control of the receiver from the sending station. The fundamental idea is automatic transmission from a perforated strip of paper and receiving by photographing the movements of a telephone diaphragm.

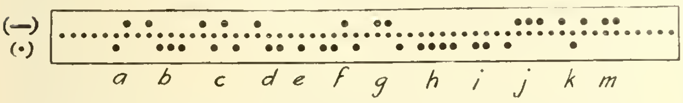


Fig. 1.—High-Speed Automatic Telegraphy.—Tape at Transmitting End Showing Dashes and Dots.

Those who witnessed the experiments between New York and Chicago saw perforated strips similar to that shown in Fig. 1 fed into the "sender" and a series of irregular lines flashed upon a reflector, like the reproduction presented in Fig. 2, which is made from a photographic record taken on one of the trials. The apparatus employed is shown in the diagram Fig. 3. The illustrations are presented through the courtesy of the Western Electrician, from which the following description is taken :

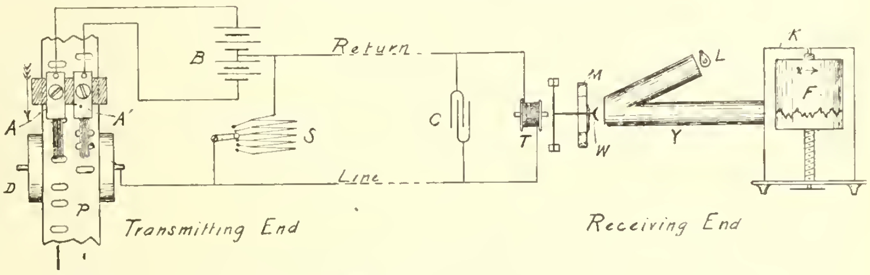


Fig. 3.—High Speed Automatic Telegraphy. Details of Apparatus.

In the preparation of the message the paper strip is perforated with two parallel lines of holes, one line representing the dashes and the other the dots of the Continental alphabet. In Fig. 3 (P) represents the paper strip; (A) and (A') are two brushes composed of fine wire mounted above a flanged drum or wheel (D) and arranged to press the paper strip firmly against it. The paper strip is moved forward in the direction of the arrow, and, as the line of holes representing the dashes pass under the brush (A), for each one there is made an electrical contract between (A) and the drum (D), and current passes from the positive pole of the battery (B) to the line. When a hole representing a dot passes under brush (A') the contact between it and the drum (D) permits the passage of negative current to the line. These impulses are carried to the telephone receiver (T), and the resultant movement of the diaphragm causes a ray of light to vibrate in the following manner : In front of the diaphragm is a small C-shaped permanent magnet (M), one pole of which terminates in a stiff flat spring having a right-angled knife edge at its free end, which is very close to a similar knife edge formed directly on the other pole of the magnet. A very small concave mirror (W) is held magnetically against the two knife edges through the means of a small bit of soft iron glued to its back. A stiff piece of wire is connected rigidly between the telephone diaphragm and the flat spring of (M). It follows that the very slight motion of the diaphragm is transmitted to the spring and the mirror is caused to rock upon the fixed knife edge of the magnet. The light from a small incandescent lamp (L) passes through one limb of the forked tube (Y) and falls upon the mirror (W), from whence it is reflected through the other limb of the tube (Y). A light-proof case (K) is securely joined to the tube (Y). Inside the case (K) is a cylinder (F) carrying a sheet of light-sensitized paper. This cylinder is rranged to rotate around a stationary coarse-pitched screw, so that for each rotation the cylinder moves downward about one-quarter inch. The sending station is given control over the starting of the cylinder (F) by a simple automatic apparatus.

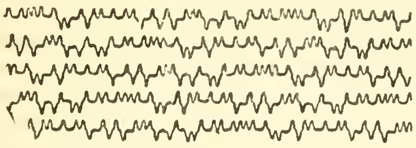


Fig. 2.—High-Speed Automatic Telegraphy.—How the Message Looks Coming Over the Wire.

In receiving a message the cylinder (F) is rotated, the beam of light from the mirror (W) dances up and down, leaving its spiral, zig-zag chemical trail to be developed later and fixed as in photography and then translated.

An adjustable self-induction coil (S), Fig. 3, is connected at the transmitter as shown. Its function is to regulate the time duration of the impulses, proportionating them to the resistance and capacity of the line. A condenser (C) shunts the telephone receiver, as shown, for the purpose of damping the self-vibration of the diaphragm. Without this the diaphragm would not come at once to rest following each movement, but would make several short vibrations after each current impulse. The condenser prolongs or "tails off" the impulse so that the current just ceases as the diaphragm reaches the central or neutral position.

Telegraph officials in this country have encouraged the inventors, Anton Pollak and Joseph Virag, of Budapest, and they have placed every facility at their disposal for testing their apparatus on commercial lines, but none of them speak hopefully of the innovation, although they disclaim any feeling of antagonism. They point out that, taking everything into consideration—the time required in preparing the perforted strips, in developing the photographic record, and in translating the message for delivery—the advantage of high speed transmission is more than overcome by the rapidity of handling messages under the older and simpler system. The only feature of importance, they claim, that commends itself is the increase in the working capacity of existing lines made possible by the innovation, yet this would apply in only a few cases and hence would not be of universal benefit.

The United States consul at Roubaix reports that the expert of the French government has made a careful test of the Pollak-Virag system, and in his conclusions, officially communicated, he points out the following disadvantages : "The telegram must first be changed into characters, after the manner of the Morse system ; then the strips must be perforated, as in the Wheatstone system ; after reception, the photographed strips must be developed and then translated into ordinary language." It is thought that this complicated manipulation may lead to many errors in transmission, and for present use in France he concludes that the Baudot machine actually employed answers all requirements.

AS A TELEGRAPH OPERATOR.

The telegraph has always played an important part in war, and the official operator at the scene of action should combine skill with resource and good judgment. The proposed distribution of medals by the Dominion Government to the Canadian veterans of '66, recalls to mind that on the occasion of the Fenian invasion, about 10,000 troops were sent out from Montreal to protect the border line between the province of Quebec and the States of New York and Vermont. Attached to these troops was an official operator—a lad in his 'teens, supplied by the Montreal Telegraph Co.—A. B. Smith by name, now the well known and highly esteemed Superintendent of Construction for the G.N.W. Telegraph Co. Young Smith had his headquarters in a bed-room on the top story of the hotel at Hungerford, and during his stay at the "front" proved himself equal to all the demands of the occasion. When the Government medals are given out, as we hope they may be this year, the "official operator" of the Montreal contingent should be found on the list.

The Mayor of Toronto has outlined a proposal for the nationalization of the telephone and telegraph systems of the Dominion. An interesting discussion on this subject took place in the Dominion Parliament last month, during which the unsatisfactory telegraph service of Prince Edward Island was incidentally referred to.

ENGINEERING and MECHANICS

EXAMINATION QUESTIONS.

W. H. WAKEMAN, in The Tradesman.

The following seventy-five questions compose a list that was used one year by the examining committee of an engineering society for the purpose of testing the theoretical and practical knowledge of the men who applied for admission to its membership. No one candidate was asked to answer all of them, but selections were made according to the ability of the candidate and the time at the disposal of the committee.

Some of the points touched upon are in dispute among the best engineers in our land, and these are not supposed to be settled by us, but the answers given are sufficient to convince any reasonable committee or examining board that the candidate who gives them has some good ideas on the subjects, and few if any rejections will occur if these replies are given in an intelligent manner :

1. What is the first duty of an engineer on entering his engine and boiler rooms in the morning ?

A. In a plant where he does the firing, his first duty is to ascertain where the water level is in the boilers, opening the valves on the water gauge, and trying all of the gauge cocks. If the pressure has all disappeared during the night, and a partial vacuum formed above the water line, the safety valve or some other valve should be opened to admit air. The practice adopted by some careless engineers, of starting up their fires before they know how much water they have, cannot be too strongly condemned. In all cases where the engineer has one or more firemen, he should know that they are in their proper places ready for duty, that there is plenty of water in the boilers, and that on general principles nothing will prevent starting up on time.

2. What is the last duty of an engineer at night ?

A. To see that his boilers are filled to the upper gauge cock with water, then to shut off the water gauges, and know that the fires are properly banked so that no steam will be formed during the night.

3. How would you bank a soft coal fire at night ?

A. Where the draft is very strong and the dampers are not tight, the surest way is to shove the fire back until nearly one-half of the grates are bare, then cover it over with fine coal that has been well wet down. In some cases it is customary to cover the fire just as it is used on the grate, but this is only done with safety where the draft can be effectually shut off.

4. Which cock or valve on the water gauge would you open first in the morning ?

A. The top one, in order to blow steam through the glass and warm it up. If the lower one is opened first the water will be projected upward, and when it strikes the closed upper cock or valve it may break the gauge glass. It also throws water from the bottom of the boiler up into the top of the column, where it is not wanted.

5. Do you blow down your boilers every morning ?

A. Yes. There is no better plan to be found than to open the blow-off valve a few seconds before the fire has started to make steam for the day. As the water has had a chance to settle during the night, some of the sediment will be blown out, and the blow-off pipe will never get clogged with sediment. Where this precaution has been neglected, blow-off pipes have been burnt off because there was no water in direct contact with the iron.

6. What compound do you recommend for the removal and prevention of scale ?

A. I have no particular kind to recommend for all cases, but would select one that would meet the requirements of a given case.

7. When the water is low in your boiler, how do you proceed ?

A. I never let the water get low in a boiler that I have charge of, unless it is caused by some accident that is beyond my control, such as the bursting of a pipe, or something similar. In such a case I would cover the fire with wet coal as quickly as possible, or with wet ashes if the coal was not at hand.

8. Would it not be better to haul the fire in order to be sure that no heat is left to burn the boiler ?

A. No, because an attempt to haul a fire results in great increase of heat for a short time, when it is liable to do much damage.

9. If your boiler foams, how would you proceed ?

A. Partially close the throttle valve, open the blow-off valve, and blow down, then close it and feed in more water rapidly. As soon as possible the cause of the trouble should be removed, as it may wreck the engine.

10. How would you reverse an engine ?

A. If the valve gear is operated by an eccentric, and the valves have neither lap nor lead, the eccentric may be turned half way round the shaft and fastened there. The engine may be placed on one of its centers as a matter of convenience, but not of a necessity. These directions apply to a majority of engines now in use, but there are many special forms that require special directions, and there is at least one that cannot be reversed, so that if it is desired to reverse the motion of the driven machinery, the engine must be turned around on its foundation.

11. Suppose that the valve gear on your engine is driven by an eccentric held in place by set screws, and it should slip on the crank shaft, how would you proceed to set it in order to avoid delay in the mill or factory ?

A. I should place the engine on one of its centers, partially open the throttle valve and move the eccentric in the direction that the engine runs until steam appears at the open drip cock, or indicator pipe at the end of cylinder where the piston is, and fasten it there. This will make it possible to run the engine until there is an opportunity to apply the indicator and properly adjust the valves.

12. Does keying up the crank pin and wrist pin boxes to take up lost motion lengthen or shorten the distance between the centers of the crank and wrist pins.

A. This will depend upon the design of the connecting rod, for with some kinds keying up shortens the distance, while with others it lengthens the same. The best design has one of each of these devices, so that the distance mentioned is kept practically constant. In common practice this is called lengthening or shortening the connecting rod.

13. What is a counterbore ?

A. When the cylinder of an engine is bored out, a part at each end is made larger than the mainpart, and each one of these is called a counterbore.

14. A crank is 12 inches long. What is the stroke of the engine.

A. Twenty-four inches.

15. Which way does the water circulate in an ordinary tubular boiler ?

A. Commencing at a point directly over the fire, it rises, then flows toward the rear end, falling to the lower part, then travels toward the fire box to replace what is constantly rising.

16 What causes draft in a chimney ?

A. The difference in weight of the hot gases inside of it, and the colder air on the outside.

17. How many square feet of grate surface are under your boiler ?

A. This, of course, will depend upon the design of boiler and grate. With an ordinary tubular boiler it is only necessary to multiply the length by the width to determine the square feet contained. For an upright boiler with a circular grate, the diameter must be squared (multiplied by itself), and the product multiplied by .7854. For a Hazelton boiler or any other kind where the grate is circular in form with a water leg in the center, the outer diameter is squared, also the diameter of water leg, and the latter subtracted from the former. Multiply the remainder by .7854 and the product will be the number of square feet in the grate.

18. How would you stop a man-hole gasket from leaking without shutting down the boiler.

A. There is no safe way to do this, for it a light pressure on the nut will not stop the leak it is best to cool off the boiler and ascertain the cause of the trouble.

19. How many kinds of safety valves are in general use at the present time ?

A. Two. Pop valves and leaver valves.

20. What causes a safety valve to blow after the boiler pressure is reduced twenty pounds below the blowing off point ?

A. Such action would denote that some part of the valve did not work freely. The lever should be lifted gently, and then forced down into place. This may stop it temporarily, but whenever a safety valve fails to work properly it should be repaired as soon as possible.

21. Suppose that your safety valve is set to blow at 80 pounds, but on returning to your boiler room after a short absence you find 100 pounds by the gauge, how would you proceed?

A. The excessive pressure shows that the valve is fastened to its seat from some cause, and if the lever is disturbed under such conditions it may suddenly release it, thus throwing a great stress upon the fulcrum and lever, which may cause a break that will allow the steam to be discharged with great force until the boiler is empty; therefore, it would be proper to cover the fire with fresh coal and check the draft, as soon as the unusual pressure is discovered, and use the steam as fast as possible in order to reduce the pressure, after which the lever may be carefully lifted and the valve opened.

22. How would you repair a dash pot that will not work?

A. That will depend on what the trouble is, for they are usually made very substantially, so that few repairs are necessary.

(Note—This question was introduced to test the candidate's knowledge of dash pots.)

23. What kind of oil would you use in the gag pot on a governor?

A. A light oil that will not quickly gum up the parts. Kerosene is frequently used for this purpose.

24. How thick would you carry a soft coal fire?

A. That would depend upon the amount of steam that the boiler must supply. If it is worked up to its full capacity the fire should be about twelve inches thick, but if the work is lighter a thinner fire will answer every purpose and probably give better results.

25. How would you proceed to abate a smoke nuisance?

A. In some cases the amount of black smoke emitted from a chimney may be greatly reduced by putting soft coal on the dead plate and allowing it to remain there for a short time, then shoving it on to the grate, for in this way the gases must pass over the fire and become ignited. Admitting air at the bridge wall is a good plan, and in some cases a jet of steam in the furnace makes a great difference. A large fire box makes it possible to get good results with little smoke.

26. What is a horse power?

A. 33,000 pounds raised one foot high in one minute.

27. How do you square a circle?

A. Multiply one quarter of the circumference by the diameter, or square the diameter and multiply by .7854.

28. How do you calculate the power of an engine?

A. Multiply the effective area of the piston expressed in square inches by the number of feet travelled perminute by the piston. Multiply the product by the mean effective pressure and divide by 33,000.

29. How do you determine the mean effective pressure acting on an piston of the engine?

A. By taking indicator diagrams and calculating it from them.

30. Is there more power developed on one side of the piston than on the other?

A. Yes, because on an ordinary simple engine, and also on a cross compound engine, the piston rod covers several square inches on one face of the piston.

31. At what part of the stroke does the piston travel at the highest rate?

A. Taking for example a horizontal engine and dividing the circle made by the crank pin to halves by a vertical line, the piston reaches its highest speed while the crank pin is travelling the half nearest the cylinder.

32. How would you determine the stress on a stay bolt?

A. Multiply the distance in inches between the vertical rows by the distance between the horizontal rows, and the product so obtained by the steam pressure. The final product is the stress on the stay bolt.

33. What is meant by the horse power of a boiler?

A. The evaporation of thirty pounds of feed water at a temperature of 100 degress Fah. into steam at seventy pounds gauge pressure. If the boiler is run under different conditions, the results must be reduced to an equivalent to the above.

34. How many square feet of heating surface constitutes one horse power in a boiler?

A. This will depend upon the grade of coal used and the available draft. For ordinary stationary practice with natural draft, fifteen square feet for a horizontal tubular boiler, or a water tube boiler, although some boiler makers have reduced this to twelve on account of competition.

35. How do you deremine the heating surface of a steam boiler?

A. By determining the number of square feet in the shell heads and tubes, on which the fire is effective on one side, and that are covered with water on the other, and adding them together.

36. Does the boiling point of water in a steam boiler increase with the pressure on its surface?

A. Yes.

37. Why are hand holes and man holes made oblong instead of round?

A. In order to make it possible to remove the covers from the boiler when necessary, also to avoid cutting away the material as much as possible.

38. The area of a safety valve is twelve square inches, the distance from fulcrum to valve is 4 inches, and the distance from fulcrum to end of lever is 30 inches. With a steam pressure of 100 pounds, how much weight must be put upon the end of lever in order to balance the pressure, neglecting the weight of valve and lever?

A. 160 pounds. It is determined by multiplying together the area of valve, its distance from the fulcrum and the steam pressure, and dividing by the length of lever.

39. The pitch of rivets in a double riveted seam is three inches, and the diameter of rivets is three-fourths inch. What is the strength of net section of plate, compared with solid plate?

A. 75 per cent. of the strength of the solid plate. It is determined by subtracting the diameter of rivets from the pitch and dividing by the pitch.

40. Which will stand the greater pressure, a large boiler or a small one, all else being equal?

A. A small boiler, because there is a less number of square inches exposed to pressure.

41. Which is the more economical, a high or a low-speed engine?

A. So far as actual consumption of steam per horse power developed is concerned, the low speed is the more economical, but other conditions may make it advisable to use a high-speed machine.

42. Is it advisable to give an engine compression; and if so why?

A. Yes; because it results in a more quiet and easy running engine.

43. Why is lead given to an engine?

A. In order to secure a high pressure of steam at the beginning of the stroke and maintain it to the point of cut-off.

44. In what position does the eccentric of an engine stand in relation to the crank on one of its centers?

A. If the connection between the valve and the eccentric is direct, and the valve has neither lap nor lead, the eccentric will stand at right angles to the crank and in advance of it. If the connection is indirect, it may stand in the same relation, or it may be 90 degrees behind it. If the valves have lap and lead, the eccentric must be advanced accordingly.

45. What is meant by the "angular advance" of an eccentric?

A. It means the number of degrees that the eccentric is advanced beyond an angle of 90 degrees with the crank.

46. How would you proceed to line up an engine?

A. Take off the cylinder-head, remove the piston and rod, draw a line through the center of the cylinder, and ascertain if the guides are parallel to it; also see that the line passes through the center of the cross head at all parts of the stroke. If the wrist-pin cannot be removed, this must be done by measurement. The crank-shaft must be square with this line, the crank parallel to it, and the crank-pin at right angles to it.

47. Does a crank-pin wear flat or round?

A. As nearly all of the wear comes upon one side of the crank-pin the tendency is to wear flat, although there may be exceptions to the rule.

48. In what position would you put the crank of an engine when keying up the crank-pin boxes?

A. With a new engine it makes no difference about the position of the crank, but with an old engine having a flat crank-pin if the engine is put upon a center and keyed up closely, it will bind and heat when started up.

(To be continued.)

Mr. E. Beck, of the Goderich Water Works Department, has been appointed engineer of the Bennett Furniture Company, of London, Ont.

A branch of the Canadian Association of Stationary Engineers has been organized at Vancouver, B. C., with the following officers: J. Saslet, president; W. Patten, vice-president; J. R. Bodger, secretary; Angus McAllister, treasurer; Chas. McFarlane, conductor; Joseph Cameron, bookkeeper; Messrs. Ryder, Dunham and MacFarlane, trustees.

SERIES ALTERNATING-CURRENT ARC LAMPS.

The successful operation of arc lamps in series on alternating current seems to be entirely assured, and has given to the alternating system the final element to enable it to compete in all particulars with the direct current system.

The San-Gabriel Electric Company, of Los Angelos, Cal., are putting in the largest plant of series alternating arcs yet installed, and will use 850 Manhattan lamps and nine regulators. The operation of the lamp is mechanical rather than electrical, the loss in the mechanism being claimed to be but five watts. The mechanism is of the concentric single solenoid type and contains no springs. The lamp carries an electrical cut-out, thus affording protection to the mechanism. They can be placed upon circuits of any current from five to eight amperes without change of adjustment. The arc voltage is said to remain constant under all conditions. At 6.6 amperes, and 72 volts at the arc, the total apparent watts at the terminal is 475 ; total true watts 430. The true watts at the arc are 425, showing the loss to be five watts in the mechanism and the efficiency of the lamp to be .99. The power factor of the lamp is .91. In connection with these lamps the San Gabriel Company will use nine regulating reactance coils of 25 per cent. capacity ; in other words, each coil will take care of the extinguishing of 25 per cent. of the circuit. The regulator consists of a single, automatic, regulating reactance coil in series with the lamps.

A single coil is swung at one end of a lever arm, so that by moving vertically it will enclose more or less of one leg of an upright "U" shaped core, the other leg acting to complete the magnetic circuit. At the opposite end of the lever arm is a weight which overbalances the weight of the coil, so that normally the coil is held outside of and above the core. When the circuit is completed to start the lamps, magnetic attraction causes the coil to be drawn down over the core. The action of the weight holds the coil in equilibrium when the desired current is flowing through the circuit. When lamps are switched off and the current tends to rise, the coil is drawn to further enclose the iron, the reactance effect increases, and the current is thus held constant. This regulation is claimed to be absolute to within one-tenth of an ampere, on any size regulator or at any load.

The loss in the regulator is, of course, constant, either at full or minimum load, being simply the C^2R loss in the coil, plus a very slight iron loss. Regulation is said to be perfect to within onettenth of an ampere from maximum to minimum load.

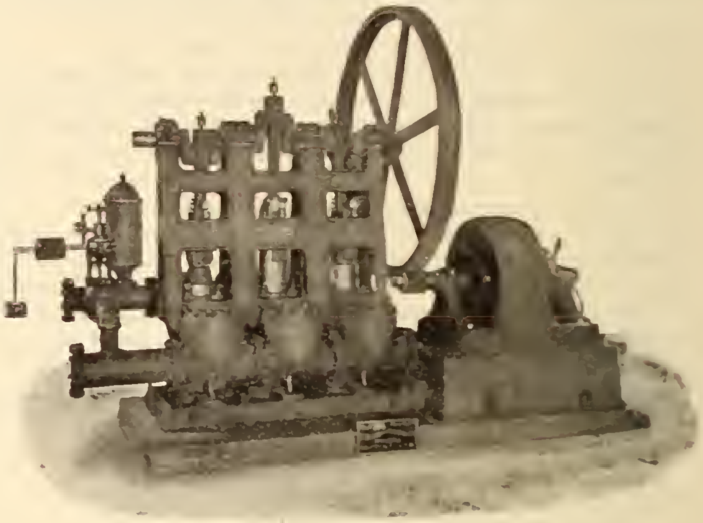
The capacity of the regulator, the insulation, etc., need only be in proportion to the number of lamps to be extinguished. This gives a very simple and compact device. It will be seen that where the regulator is to take care of but 10 per cent. of the load of the circuit, it requires an insulation against only ten per cent. of the total electro-motive force of the circuit, so that a large number of lamps, with a very high voltage, can be handled with safety. The loss in these coils is said be but 200 watts at any load, and as there will be but nine coils employed in this installation, the loss in the regulators will be 1,800 watts. The power factor of the circuit, including lamps and regulators, is 89 to 90. The lamps will run 100 in series on a 7,500 volt primary circuit. The Manhattan General Construction Company of Newark, New Jersey, furnished the apparatus for this installation.—Electrical Review.

THE SMITH-VAILE TRIPLEX ELECTRIC PUMP.

One of the latest designs of the Smith-Vaile triplex electric pump of outside packed and outside guided type is illustrated herewith. The apparatus was constructed for and installed at the plant of the National Cash Register Co., Dayton, Ohio. It is connected to two 8 inch bored wells, and supplies an abundant water supply for general purposes.

The National Cash Register Co. have supplied a separate apartment for the installation of the pump about 10 feet below the floor line of the main engine room, so that the pump might be installed as near the water level in the wells as possible. Special underground passage gives communication between the engine room and the pumping station for the accommodation of the operating engineer.

The sub-base of the pump is extended for the reception of a General Electric direct connected motor, provided by the National Cash Register Co. This motor is of the slow speed type, 500 volt current, and its speed is such that a single reduction of gears can be employed. The main gear is of large diameter, machine cut. The pump and motor pinions are of rawhide. The pump is of the four standard type, each crank being provided with two bearings and two supports. It is also of the cross head design, cross-heads being provided with bronze shoes, adjustable for wear. Connecting rods are provided with bronze boxes at crank shaft connections, with taper key adjustment. Adjustment device is also provided at the cross-head connections. Valve areas and water passages are extra large, admitting of high speed without undue noise or hammer.


THE SMITH-VAILE TRIPLEX ELECTRIC PUMP.

The pump is also provided with automatic combination by-pass and water relief valve of a special design, whereby the pressure is maintained at a constant point, and when the maximum is obtained, the surplus water is by-passed from discharge to suction, speed of the motor remaining constant.

The Goderich Organ Company have lately put in a new 100 light dynamo, manufactured by the United Electric Company, of Toronto. It is operated by an automatic high speed engine from the Bell Engine Works, of Seaforth.

The London Cold Storage & Warehousing Co., London, Ont., have placed an order with the Electrical Construction Co., of that city, for a 30 k.w. direct connected generator and engine for 250 volt service to supply the lights of the building and two motors of 10 and 15 h.p. respectively, which have also been ordered from the Electrical Construction Co., of their Perfection type multipolar machines.

The Pittsburg Reduction Company, of Niagara Falls, Ont., are building a plant at Shawinigan Falls, Que., for the manufacture of aluminum, and have awarded to the Westinghouse Electric & Mfg. Co., of Pittsburg, Pa., a contract for four generators of 1,250 horse power each. The Shawinigan Water & Power Company are also said to have contracted with the Westinghouse Company for two generators of 5,000 horse power each, to be used in the development of electric power for their customers.

SPARKS.

The town of North Toronto may install an incandescent lighting plant.

A fire alarm system may be installed by the corporation of Hintonburg, Ont.

The Kingsville Electric Light Company have installed a Leonard self oiling engine.

Cope & Frey, dealers in electric and gas supplies, have commenced business at Vancouver, B. C.

The power house of the Niagara Falls Park & River Railway at Niagara Falls, Ont., is being rebuilt.

The Cataract Power Company, of Hamilton, have made another reduction in their rates for lighting.

The Electric Development Company, of Philadelphia, purpose opening Canadian offices in the city of Hamilton.

The corporation of Cannington, Ont., is considering the purchase of the electric light plant from the present owners.

The electric lighting plant at Amherstburg, Ont., has been taken over by Mr. R. M. Saxby, late of the Royal Electric Company.

A proposition has been made by Tuerk Bros. to establish a factary in Berlin, Ont., to manufacture gasoline engines and automobiles.

A convention of electrical contractors of the United States was held in Pittsburg on March 16th.

The town council of Perth, Ont., have been looking into the question of electric lighting, and a report has been submitted recommending municipal control.

The streets of Port Dalhousie, Ont., are now lighted by electricity from the power house of the Toronto Rubber Shoe Company. There are fourteen arc lights in the streets.

G. Filieux, a lineman in the employ of the Royal Electric Company, Montreal, was recently killed by an electric shock at the corner of St. Lawrence street and Mount Royal avenue.

A considerable portion of the British Columbia Electric Railway Company's lines in Victoria will be double-tracked this year. It is also the intention to put in service several new cars.

Dr. Edward Gahan, of Boston, is understood to be in negotiation for the purchase of the electric light plant at Digby, N.S. If purchased, an additional dynamo and engine will be installed.

The tender of the Royal Electric Company has been accepted by the city of Halifax, N. S., for the supply and installation of an electric light plant. The tender is understood to have been $19,438.

The Bay of Quinte Railway Company, of Deseronto, is seeking authority from the Dominion Government to operate mines, supply electrical power and manufacture electrical machinery. It is improbable that their requests will be granted.

McColl Bros. have been given the contract for boiler compound required by the city of Toronto, at 4 cents per pound, and for cylinder oil at 35 cents per gallon. The Atlantic Refining Company secured the contract for lubricating grease, at 10 cents per pound.

A Paris newspaper gives the following as the number of automobiles in use: Automobiles registered in Paris, 3,701; in the suburbs of Paris, 1,219; in the rest of France, 2,445; in the whole of Germany, 1,427; in the whole of England, 530; in the United States, less than 300.

The Railway Committee of the Ontario Legislature has reported the bill reviving the charter of the Ingersoll Radial Electric Railway, granted in 1897. The line will connect Ingersoll with Tilsonburg. The town council of Ingersoll have also decided to grant a franchise to the company.

The Engineering Society of the School of Practical Science, Toronto, have elected officers for 1900 as follows: President, F. W. Thorold; Vice-Pres., W. G. Chace; Graduate Reporter, C. H. Fullerton; 4th Year Reporter, R. Roaf; 3rd Year Reporter, J. T. Broughton; Treas., R. W. Morley; Cor. Sec., W. Brereton; Rec. Sec. A. Lang.

A charter has been granted to the Electrical Maintenance and Construction Company, Limited, of Toronto, with an authorized capital of $250,000. The provisional directors are: P. H. Patriarche, H. L. Dunn and P. D. Ball. The charter gives the company power to manufacture and operate electrical machinery, and to carry on the business of an electrical, mechanical, hydraulic and civil engineer.

Sir William Van Horne and James Hutchison, of Montreal, B. F. Pearson and Charles H. Cahan, of Halifax, and other Canadian capitalists, have obtained an exclusive franchise to operate electric railways and furnish light and power in the city of Port of Spain and the suburbs to a distance of five miles. The capital of the company will be $1,000,000.

The Hamilton, Grimbsy and Beamsville Electric Railway Company sued the Bell Telephone Company in the Division Court, Hamilton, for $60 damages for injuries to its poles and wires caused by the defendant's removal of its broken wires and poles after the snow-storm of December, 1898. Judge Monck has ruled that the defendant is not liable under the circumstances.

The new power house and plant of the Ottawa Electric Railway Company was completed last month. The work was supervised by Mr. W. H. Baldwin, hydraulic engineer of the company, and upon the inauguration of the plant he was presented with a beautiful gold watch by the president and directors in recognition of his efficient and faithful services. In a later issue we hope to publish a complete description of this power house.

The Society of Applied Science of McGill University, Montreal, have elected the following officers for the coming year: President, H. A. Burson; first vice-president, B. S. McKenzie; second vice-president, S. B. Clement; third vice-president, R. C. Wilson; treasurer, A. E. Beck; second year representative, E. Mackay; chief of the editorial board, A. R. Archer; members of the editorial board, H. E. Scott, G. Pike and J. A. Heamen.

The Cataract Power Company have commenced work on the construction of their second transmission line from the power house near St. Catharines to the city of Hamilton. It is expected that the line will be completed by the first of July next. The new line will have twice the capacity of the present wires, and will necessitate the increasing of the plant at the Victoria avenue transforming station in Hamilton. The investment for copper wire alone will be about $50,000.

Mr. W. T. Steward, electrical engineer, has submitted a report to the town council of Toronto Junction on the required changes in the lighting system of the town. Mr. Steward estimates the cost of putting in a lighting plant at the present power station at $16,000, and to place it at the water-works station at $12,000 additional. He recommends two 50 arc light dynamos at a cost of $1,000 each, one 100 k. w. alternator with instruments and switchboard, at a cost of $2,500, one 150 h. p. high speed compound engine at $1,650, and two 150 h. p. boilers at $1,200 each. The cost of transformers for 1,200 lights is placed at $1,800. Upon the basis of his estimate, the cost of lighting the streets with 100 arc lamps would be $3,419 per annum.

An interesting legal suit is now being heard in the Assize Court at Toronto. It will be remembered that in September, 1899, the warehouse of W. G. Harris, scrap merchant, was destroyed by fire, and that suit was brought against the Toronto Electric Light Company to recover damages, on the ground that the fire was caused by an electric wire. The action has already been tried and a verdict for the full amount given in favor of the plaintiffs, but the defendants claim that Judge Ferguson, who tried the case, failed to point out to the jury in his charge the exact hour of the fire. Harris claims that the company wrongfully placed wires on his building, and failed to properly insulate them, while the company claim that they were properly insulated, and that the fire was caused by spontaneous combustion.

In one branch of engineering, the development of steam turbines, much greater progress has been made in Great Britain and on the Continent than in the United States. In the electric lighting plant in Cambridge, England, several prime movers of this type are in successful operation. A Parsons steam turbine, directly coupled to a 500-kilowatt alternator, has been added lately. It runs at a high speed, 2,700 revolutions a minute. The regulation of the turbine is secured by an electric device, so that it can work in parallel with the other machines of the station when desired. A surface condenser leads from the turbine by piping and is installed in a space below the floor level. Beside it are the pumps for the water circulation, which are worked by gearing and endless screw from the main shaft. The alternator is of the four-pole type, with fixed field, and gives a voltage of 2,000 at 90 cycles. For the excitation 3.5 kilowatts is required at full load. The exciter, at 5 kilowatts, is connected directly to the shaft of the alternator.

HOW TO USE EMERY WHEELS.

An emery wheel manufacturing company gives this advice to users of such wheels : Too great a variety of work should not be expected from one grade of wheel. If the amount of grinding will warrant it, several grades can be profitably employed, each carefully selected for its particular purpose. Wheels should be kept perfectly true and in balance. In order that they may not become in the least out of true an emery wheel dresser should be used to dress up the wheels a little each day, or as often as they require it.

In mounting emery wheels never crowd them upon the arbor. Use flanges at least one-third the diameter of the wheel. Flanges should always be concaved and fitted with rubber washers between flange and wheel. Have wheels slip easily on the arbor and screw flanges only tight enough to prevent wheels from slipping. Stands on which wheels are mounted should be heavy and strong, and solidly bolted to a firm foundation. Keep machine well oiled so that arbor will not become heated, otherwise there is danger of wheels breaking from expansion of arbor.

Users of wheels are particularly cautioned not to run wheels on shaky machines or on machines in which the arbors have become loose in the boxes from wear. See that rests are properly adjusted in relation to the wheel, otherwise accidents may occur owing to work being drawn between the wheel and the rest. Never run wheels at a higher speed than the maker recommends. Don't try to grind malleable iron witha wheel that was made for brass, as no one wheel can be made which will be just right for all kinds of metals.

To obtain the best results, emery and corrundum wheels should be run at a surface speed of 5,500 feet per minute. Wheels if run too fast will heat the work and glaze, and if run too slowly will wear away rapidly and do but little work. The same speed should be maintained as the wheel wears down, and the speed of the spindle should be increased correspondingly as the diameter of the wheel is decreased. Where there is a sufficient amount of grinding to warrant the use of more than one machine, this can be accomplished by transferring from the first or larger grinder to smaller ones as the wheels wear down, otherwise by means of cone pulleys.

The snow storm early in March last caused a heavy loss to the Nova Scotia Telephone Company. Many of their wires in Halifax and vicinity were blown down. The cost of repairs was in the vicinity of $25,000.

Mr. W. T. Steward, an electrical engineer of wide experience has recently established an office in the Temple Building, Toronto, and is prepared to give expert advice on electrical projects, installations, and improvements to plants. It is Mr. Steward's avowed intention to take an entirely independent attitude as regards electric manufacturing concerns, and by so doing to give his patrons the benefit of unbiased advice such as is only possible under these conditions. He has just made a report on an electric lighting system for the town of Toronto Junction. Mr. Steward is well known in electric circles in Western Canada, having been for ten years electrician for the western division of the Canadian Pacific Railway, and afterwards engaged in the electrical con tracting and supply business at Vancouver, B. C.

The Western Ontario Hat Co., London, have purchased two new motors in addition to the two they already have, all being manufactured by the Electrical Construction Co., of London, Ltd.

The Erie Iron Works, of St. Thomas, Ont., have placed an order with the Electrical Construction Co., of London, Ltd., for a 12 h.p. motor, which has already been installed to their satisfaction.

MANAGER WANTED

A Practical Electrician, to run a growing plant and nest say $2,000 cash in same. A good opening for a reliable young man. Apply, with references, to "A B C" care CANADIAN ELECTRICAL NEWS, Toronto, Ont.

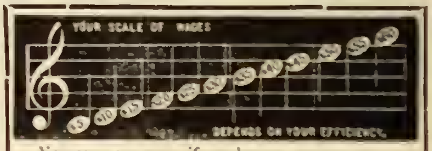
ENGINEERS, Firemen Machinists, and electricians : Send 10 cents for new 44 page pamphlet, containing list of questions asked by Examining Board of Engineers. GEORGE A. ZELLER, Bookseller, St. Louis, Mo., U.S.A. Mention CANADIAN ELECTRICAL NEWS.

WANTED

Electric Light Plant

The Corporation of the Village of Lakefield, Ont., solicits correspondence from any party or company who will install and run an Electric Light Plant in the village. Other information on application to

ALEX. BELL, M.D.,
Village Clerk.



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Power Factor—
Complete Circuit Series
Lamps with Regulator—.00.

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Regulator loss constant at all loads, 200 watts.
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At 6.6 amp., 72-volts, 430 watts. Total loss in lamp, 5 watts.
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Terminal and Arc Voltage the same. Concentric mechanism, but one magnet used in lamp. No springs.

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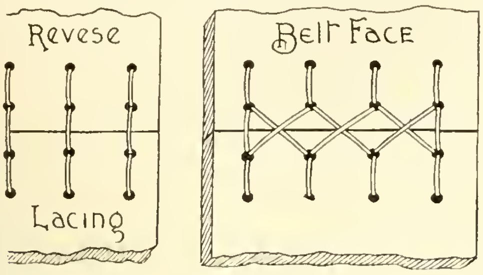
SUGGESTION FOR BELT LACING.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—Many suggestions are offered from time to time regarding the lacing of belts. Recently, I came across the double lath tie, which I have found very satisfactory, laced as follows: The lacing can be made any length in a few minutes, and with one cut of a sharp knife it is easily removed. For heavy belts I use double and sometimes treble tie. By placing the ends together, sharpening them with a knife, and sewing them with one strand of the lath tie, makes the end very stiff. I can vouch for its cheapness and lasting power.



Yours truly,
"EXCELSIOR."

Mr. Stewart Randall, of Ottawa, has been engaged as electrician by the Buckingham Electric Light Company.

Mr. Daniel Mulqueen, cashier of the Toronto Railway, has been appointed by the Mackenzie Syndicate as manager of the street railway at San Paulo, Brazil.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED THOMSON & CO.
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. **Telephone Main 3149.**

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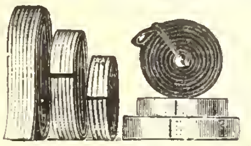
An' it's BELTS, BELTS, BELTS.—R. KIPLING.

F. E. DIXON & CO.

Oak Tanned



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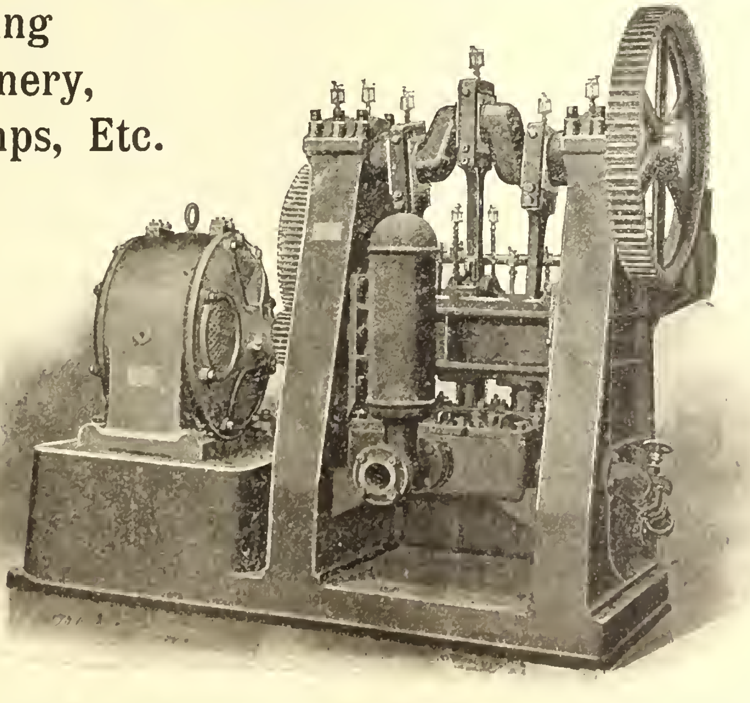

AHEARN & SOPER - OTTAWA
AGENTS FOR CANADA

RECENT CANADIAN PATENTS.

THE William Hamilton Manufacturing Company, of Peterboro Ont., has been granted a Canadian patent for a reversing steam valve, as shown in the accompanying illustration. The claim is for a steam valve, comprising a tubular valve cylinder having a feed inlet and feed exhaust ports, a valve rocking therein and having feed and exhaust passages from opposite ends alternating as described and adapted to close the feed port near one end and open the exhaust port at the other end, and vice versa, a steam chest connecting with said ports and having steam passages agreeing with said feed and exhaust ports, and feed and exhaust pipes from opposite ends of said steam chest and connecting with said steam passages and with a piston cylinder near opposite ends.

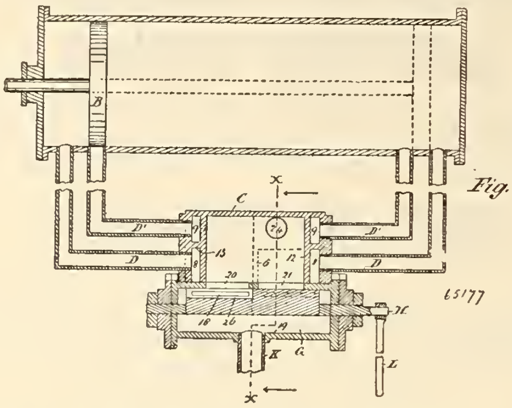

Fig. 1.

REVERSIBLE STEAM VALVE.

To Dr. Carl Ritter Auer Von Welsbach, of Vienna, Austria, has been granted a patent in Canada for an osmium filament for incandescent electric lamps. It consists of a process of making filaments for electric incandescent lamps from a paste of osmium, titantic acid or acid of a more basic character which will volatilize, when brought to incandescence, and binding material consisting in moulding the paste into threads or the desired filamentary form, subjecting the same to dry distillation, then applying the electric current, first slowly and until the carbon of the binding material has been eliminated at a comparatively low heat, then increasing the current until the filament is heated to dazzling incandescence, when the titanitc acid or oxyd used is volatilized and the impurities, when any, eliminated and the osmium cemented into a state of purity as a stable, dense, homogenous, coherent and elastic filament; in the substitution of alloys of osmium with other metals of the platinum group, and preferably ruthenium, in lieu of osmium alone, so as to produce metallic filaments suitable for use as the illuminating conductors of incandescent electric lamps, either alone or after being coated with refractory oxyd or oxyds.

A WESTERN ELECTRICAL PROJECT.

INCORPORATION has been granted by the provincial legislature of British Columbia to the Stave Lake Power Company, Limited, with an authorized capital of $1,000,000. The company have acquired the right and title to 75,000 inches of water at Stave River Falls, a point 42 miles from the city of Vancouver. It is proposed to generate the power at the falls and transmit it to Vancouver. It is said that the company are already assured of over 4,000 horse power on yearly contracts.

The directors of the company are: H. Abbott, director of the Canadian Pacific Railway Company; John Hendry, president and manager of the Hastings saw mills; W. H. Armstrong, of Armstrong & Morrison, manufacturing machinists; G.C. Hinton, electrical engineer and representative of the Royal Electric Company, Montreal; J. B. Ferguson, managing director of the company.

The hydraulic engineer for the company is Mr. Chas. A. Stoess, and the electrical engineer Mr. George C. Hinton. Reports made by the engineers state that 17,000 horse power can be generated at the falls, and that by additional hydraulic works this amount can be doubled. The cost of the project is estimated to be $515,000. Among other information given by the hydraulic engineer is the following: Width of river, 200 feet; average depth, 16 feet, running at a velocity of 7/10 of a foot per second, which gives a quantity of 140,324 cubic feet per minute. A flume will be constructed 18 feet high on a grade of one in 660, or 8 feet to the mile. This flume will pass from above the first fall to below the second fall. A dam will be constructed at the upper point and will likely be built of rock and earth backing and apron, with concrete cement cores. At the lower point of the flume the power station is to be located, and a reservoir will take the water from the flume. From this two steel pipes, 12 feet in diameter, will carry the water to the station, where there will be eight turbines developing 2,000 h.p. each. There will be four gates on each pipe, and each gate will serve a double turbine.

METERS

. . . MANUFACTURED BY THE . . .

SIEMENS & HALSKE ELECTRIC CO. OF AMERICA

To Officers and Managers of Central Stations:

The Duncan Integrating Wattmeters manufactured by the Siemens & Halske Electric Company of America are constructed after my design and under my personal supervision.

The great facilities of this Company have enabled me to complete many improvements heretofore contemplated but never until to-day accomplished.

Thos Duncan

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Write for Catalogue and Discounts.

SPARKS.

The project for an electric railway between London and Port Stanley has again been revived.

The city of Winnipeg, Man., is inviting tenders up to Monday, April 16th, for the supply of a fire alarm system.

The Electrical Construction Co., of London, Ltd., have cleared out twenty-two of their list of eighty second hand machines which were recently exchanged for new ones in Winnipeg.

The Hamilton Radial Railway Company, which contemplates the operation of an electric railway from Hamilton to Oakville and Guelph, has been granted an extension of time for beginning the work until 1905.

The Ickes & Armstrong Syndicate expect to commence work on the construction of an electric railway in the town of Woodstock, Ont., within two months. Mr. J. G. Wallace, the local representative, states that the ties for the road have already been purchased.

Messrs. S. H. Jones, S. F. McKinnon, L. M. Jones and J. A. Lowell have petitioned the Ontario Legislature for an act to authorize the construction of a system of elevated railways in the city of Toronto and adjoining municipalities, and also a system of surface street railways.

The Sutherland Construction Company, composed of New York capitalists, have secured control of the horse car line between Drummondville and Niagara Falls, Ont., and propose to electrify the road. They have deposited a check of $1,250 as a guarantee that they will install a plant before July 1st next, and have asked for a twenty-year charter.

The shareholders of the Preston & Berlin Street Railway Company have elected the following officers: John Patterson, President, Hamilton; M. M. Todd, Vice-President, Galt; C. R. Hanning, Secretary-Treasurer. The company will make arrangements at once to build a line between Preston and Berlin, thus making a through connection from Galt to Preston and on to Berlin and Waterloo.

Victor Turbines
OPERATING DYNAMOS

That there are more **Victor Turbines** in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.

FEATURES WORTH REMEMBERING

High Speed, Close Regulation, Great Capacity
High Efficiency, Perfect Cylinder Gate, Steady Motion

RECENT PLANTS INSTALLED:—Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Cataract Power Co., Hamilton, Ont.

CORRESPONDENCE SOLICITED.

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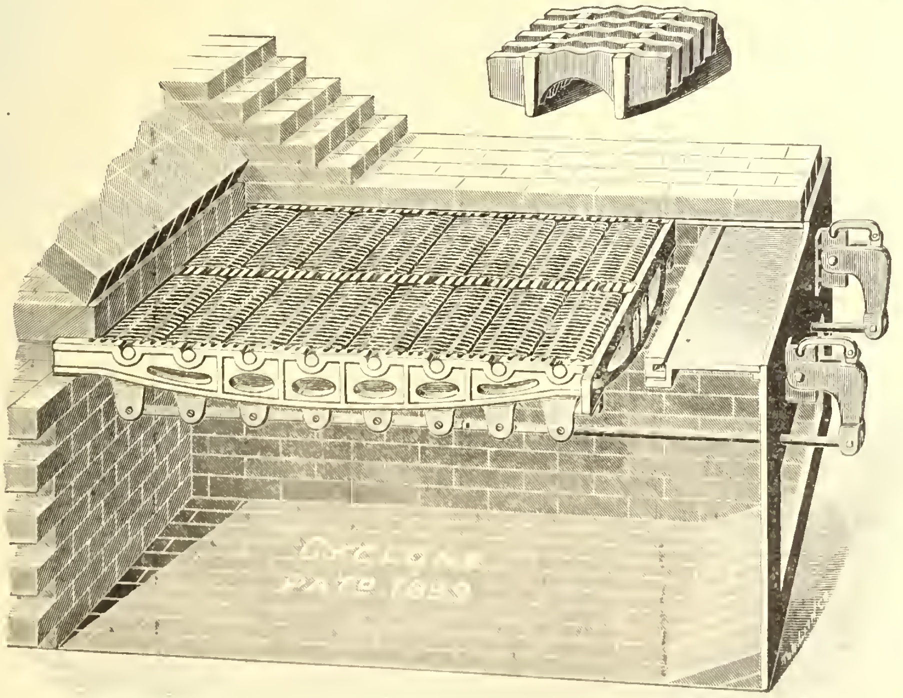
Economy of Fuel and Increased Boiler Efficiency Guaranteed

Cut shows construction of the Grate.
No alteration of Plant necessary.



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Burns the Cheapest Fuel with the Best Results.

A Boy Can Operate It

Send for Descriptive Circulars and Testimonials.

When installing new Boilers specify Cyclone Shaking Grate.

We furnish plans and specifications for setting Boilers by most modern method, to ensure economy of fuel.

We also remodel old plants to ensure the best economy in connection with our Grate Bars.

We make one claim that we agree to evaporate more water per pound of coal than any other device in America.

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Toronto Junction, Ont., Jan. 20th, 1900.

Gentlemen,—We take much pleasure in giving you our testimonial re Grate Bars. The set you put in for us is giving perfect satisfaction. They are very convenient to operate, have ample air space, and are very economical regarding fuel.

To every intending purchaser we would advise to adopt the Cyclone Grate Bar in preference to any other kind. Wishing you every success, we are,

Yours truly,
Watt & Watson.

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Cyclone Grate Bar Co., Limited

Telephone 1106. Office: 10 King Street West, TORONTO, CAN.

SPARKS.

The Raney Specialty Mfg. Co., of Kingston, have purchased rom the Electrical Construction Co., London, three motors for their new works.

The town of Bracebridge, Ont., is considering the installation of an electric power plant, and may also put in an electric fire alarm system.

The Canadian General Electric Company have invited tenders for the erection of a brick and steel addition to their works at Peterboro, Ont.

The streets of Kingsville, Ont., are now lighted by incandescent lamps, instead of arc lamps as previously. The service is said to have been much improved by the change.

The Electrical Construction Co., of London, Ltd., have sold to H. W. Petrie, of Toronto, two of their list of second hand motors, which are said to have given excellent satisfaction.

Mr. Peter Hoff, of Thornhill, near Toronto, has invented a fender for street cars, which operates by the pressing of a foot lever by the motorman.

The W. J. Gage Co., Toronto, have puchased two new motors from the Electrical Construction Co., of London, Ltd., in addition to the two slow speed press motors which they already have from this company.

The Record Printing Co., of Windsor, have purchased from the Electrical Construction Co., of London, Ltd., a 40 light multipolar dynamo. This machine was sold in close competition with several American and other machines.

The Brampton Gas Company, of Brampton, Ont., are understood to be considering the installation of an electric light plant. The plant by which the streets of the town were lighted was destroyed by fire about one month ago.

The Georgian Bay Navigation Co. have recently ordered a 300 light dynamo from the Electrical Construction Co., of London Ltd., for one of their boats. This is to take the place of a 150 light dynamo installed two years ago by the same company.

An explosion at the gas works at Listowel, Ont., slightly damaged the electric light plant, and almost completely wrecked the gas works. Mr. William Bitton, the operator at the gas works, was killed by the explosion. Since the accident, the electric light plant has been put in running order, and arrangements have been made by J. G. Hay to rebuild the gas works.

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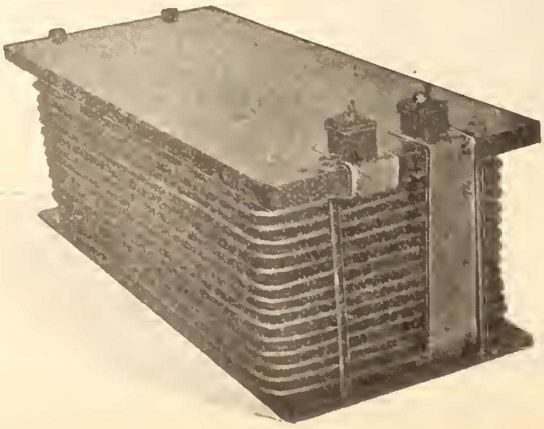
Goods will be forwarded same day that order is received

BELTS MADE SPECIALLY FOR ELECTRIC POWER USE.



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All containing cells and excessive acid omitted;
Piles of any voltage, any capacity, in one unit;
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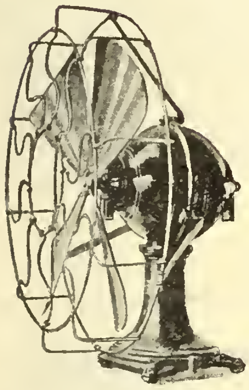

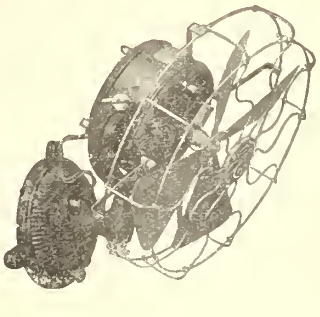

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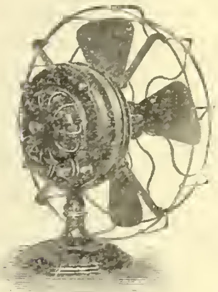
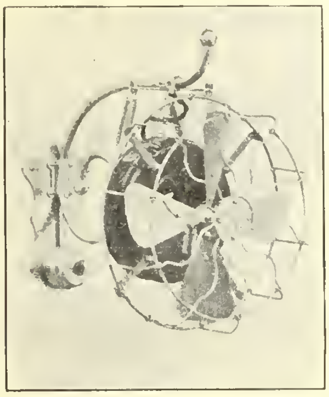
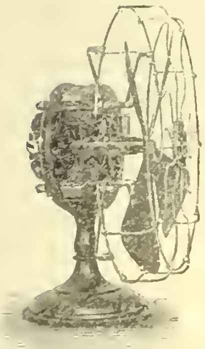
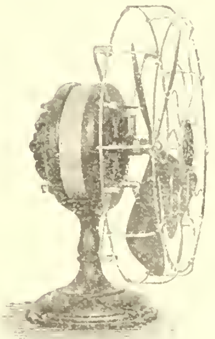
For Direct or Alternating Current Circuits









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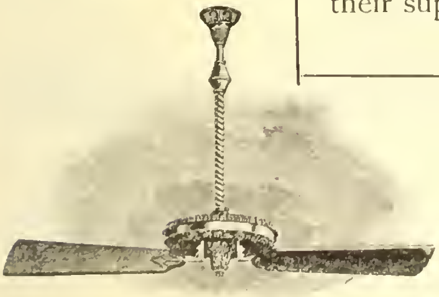

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MANUFACTURERS OF
TOPPINS,
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WRITE FOR PARTICULARS.

FOR SALE

60 K.W. Westinghouse 1000 V. Alternating Generator, with Exciter; both in good condition.

Electric Repair & Contracting Co.
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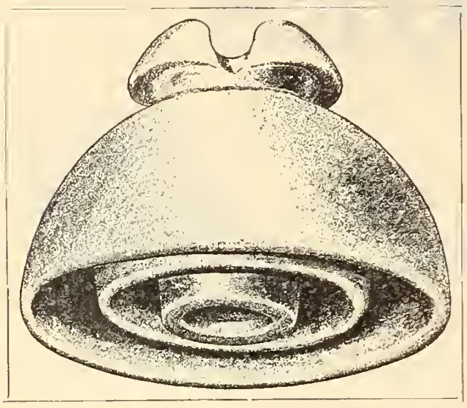

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These Insulators have been adopted exclusively by such important Canadian Transmission of Power Lines as: **West Kootenay Power & Light Co., Bonnington Falls to Rossland; Cataract Power Co., of Hamilton, DeCew Falls to Hamilton; Chambly Manufacturing Co., Chambly to Montreal; Light, Heat & Power Co., of Lindsay, Fenelon Falls to Lindsay; Town of Orillia, Ragged Rapids to Orillia, and many others in Canada, United States, Mexico and Australia.**

Address all Correspondence to— C. S. Knowles

General Agent, 7 Arch Street, BOSTON, MASS.

Scientific American, Oct. 14, 1899.

The Automobile Magazine has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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THE AUTOMOBILE MAGAZINE

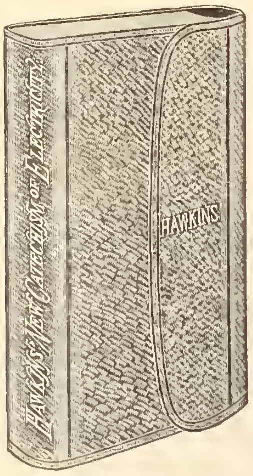
31 State Street,
NEW YORK.

$3.00 A YEAR.

N. Y. Evening Post, Oct. 9. 1899.

The new illustrated Automobile Magazine (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

Please mention the Electrical News when corresponding with advertisers.


Hawkins New Catechism of Electricity
HAWKINS

NEW CATECHISM OF ELECTRICITY A PRACTICAL TREATISE

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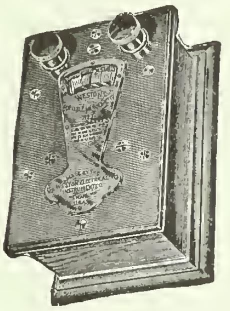

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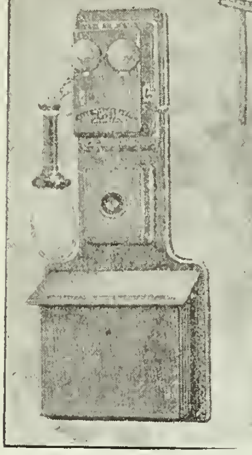

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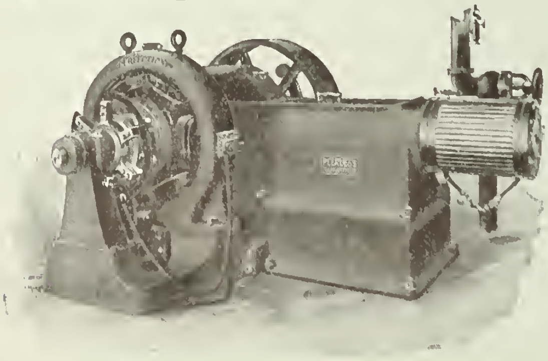

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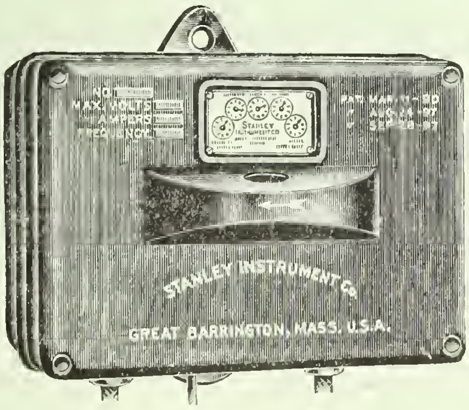

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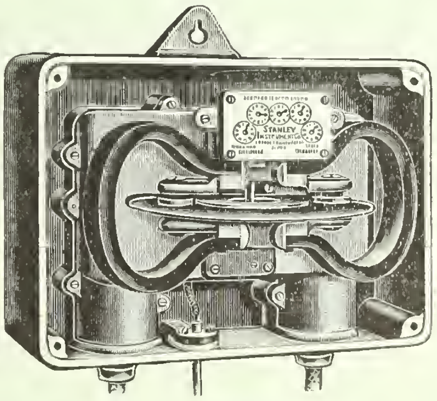

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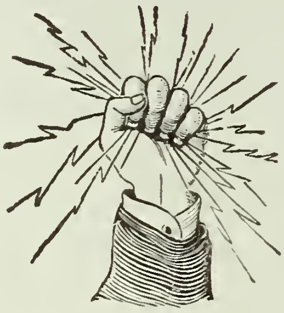

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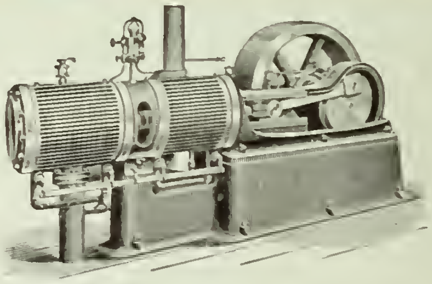

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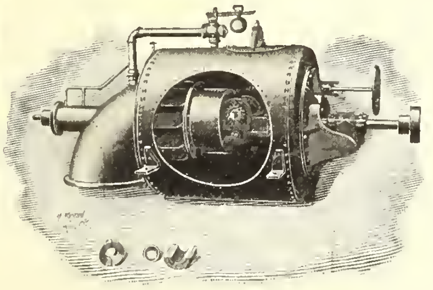

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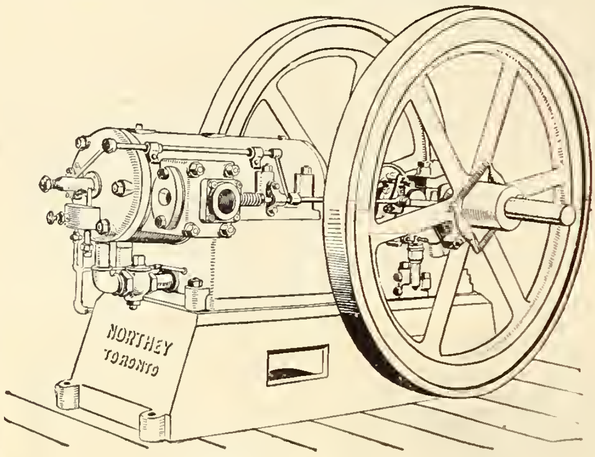

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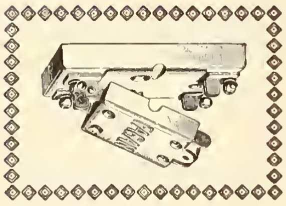

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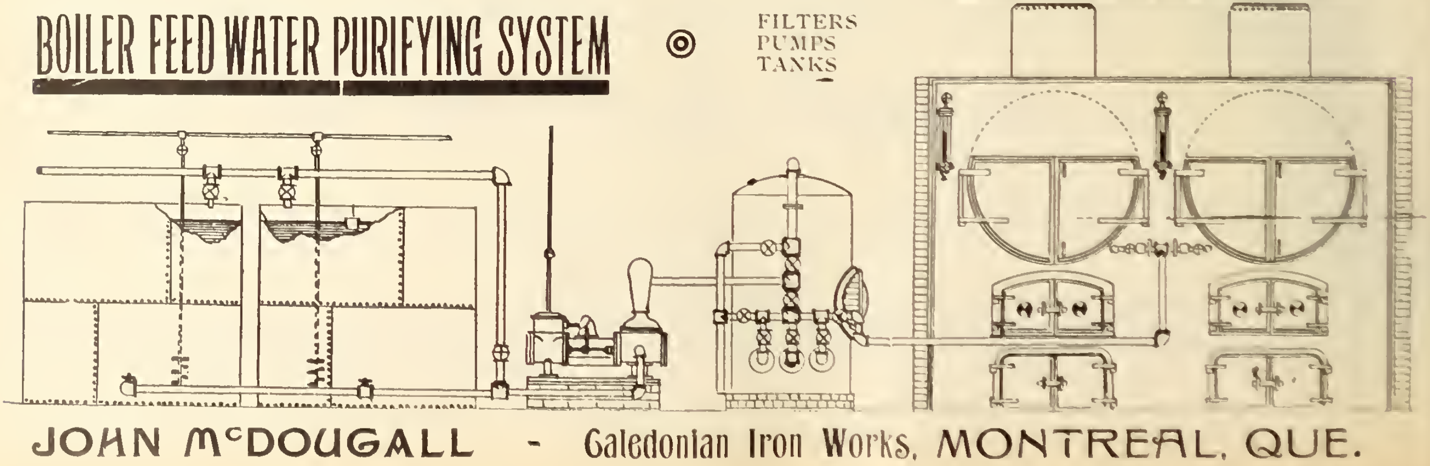

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MOUNT WHITNEY ELECTRIC POWER TRANSMISSION.

As being one of the latest and most interesting installations in the United States, we present some illustrations and particulars of the electric power transmission plant of the Mount Whitney Power Company. This plant was installed for the purpose of utilizing the waters of the Kaweah river, in California, for furnishing light and power to the cities of Visalia and Tulare and throughout Tulare county.

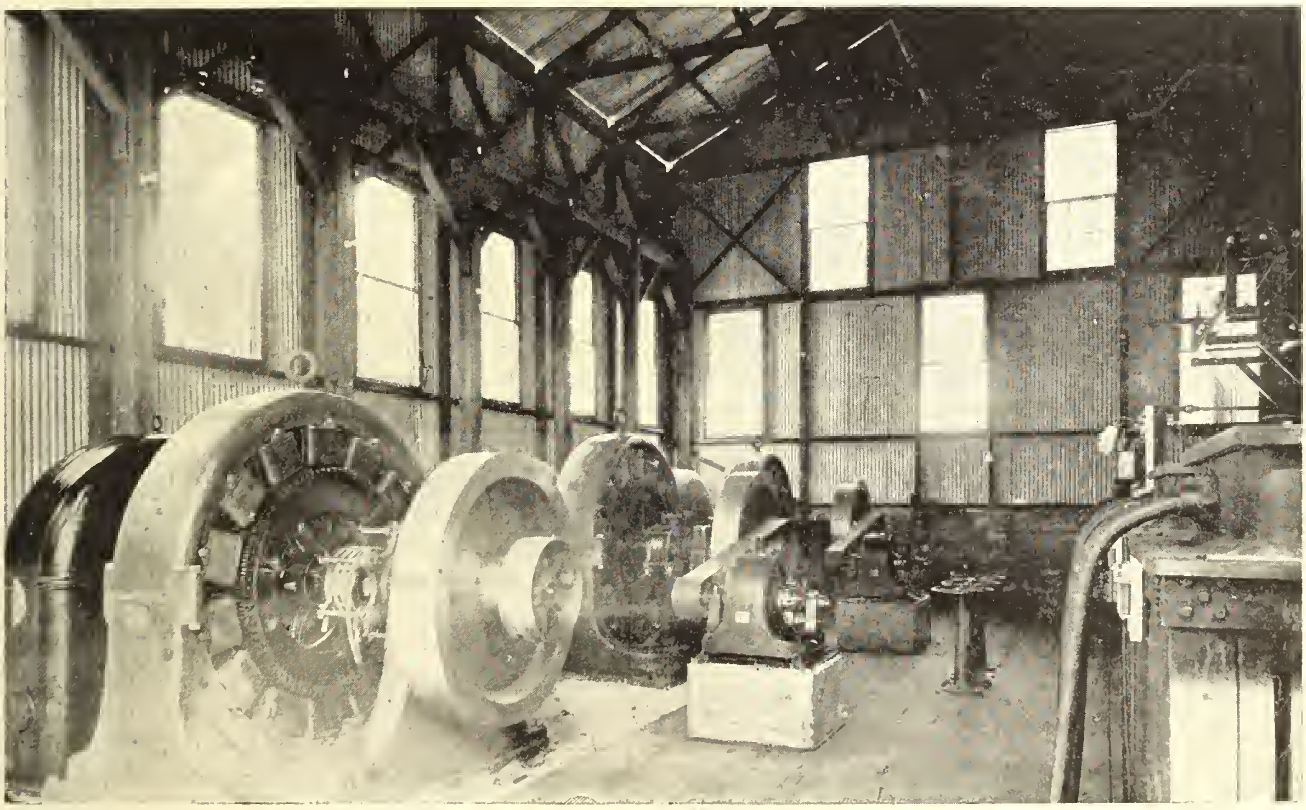

FIG. 1.—GENERATOR SIDE OF THE MOUNT WHITNEY POWER HOUSE.

The Kaweah river rises in the Sierra Nevada mountains, one of which, Mount Whitney, is over 14,000 feet above the level of the sea. The river is fed by the waters from these mountains and winds its way through the valleys, then down the canyon, over precipices and through gorges, to Tulare Lake, bearing the waters from a drainage area of 619 square miles. At a point distant about 45 miles easterly from the city of Visalia, named Oak Flat, at an elevation of about 2,400 feet above the sea level, a solid granite ledge crosses the river and forms a perpendicular bluff on the south side, as well as a natural dam of about 12 feet in height above a pool below into which the waters of the river flow, thus forming a splendid waterfall. A tunnel three feet wide and six feet high conveys the water to a flume which is 30,000 feet in length. The inside dimensions of the flume are 36 inches wide and 22½ inches deep. It has a uniform grade of 26.4 feet per mile, giving a maximum velocity of flow of seven feet per second. At intervals sand boxes and waste gates have been provided, so that any sand which might find its way into the flume during the period when the snow is melting can be easily disposed of before reaching the pipe. The maximum carrying capacity of the flume is 37 cubic feet per second. The flume terminates in a sand-box and overflow gate, at right angles to which an apron leads off to the penstock. This apron is equipped with gates which regulate the amount of water which may flow into the pipe, and also with iron racks which prevent the entrance of anything which might be floating in the water. The penstock is 6x8 feet and 16 feet deep.

THE PIPE LINE.

The pipe line extends in a straight line from the penstock to the power house. It is 3,500 feet in length, and has a perpendicular fall of 1,300 feet. It follows along on ridges the most of the way and passes down over some very steep pitches. Commencing at the penstock the pipe is 50 inches in diameter, but it tapers down to 24 inches in the first 50 feet. This acts as a funnel and gives the water an easy entrance to the pipes.

Then follows 2,100 feet of rivetted and 1,160 feet of welded pipe, from 24 to 20 inches in diameter. A portion of the pipe is at an angle of about 45 degrees, and much of it at angles from 25 to 30 degrees. The capacity, with 20 cubic feet of water per second, is 2,800 horse power to water wheels.

THE WATER WHEELS.

The power house is located about 35 miles from Visalia and is 30 × 50 feet, with an addition 12 feet square. The side of the building stands parallel with the pipe line and the water is led to the water wheels through passages of gradually decreasing area and with very easy curves. The water wheels are of the Doble ellipsoidal type and are solid steel castings, weighing about 1,400 pounds each, with 20 bronze buckets attached securely by means of two steel bolts to each bucket. A view of the Doble water wheel is shown in Fig. 2, while Fig. 3 shows a verticle section, with baffle-plates and tail-race. The steel centres are 44 inches in diameter, and the speed of the wheels is 514 revolutions per minute, giving a maximum capacity of 1,000 horse power each. The wheels are mounted directly upon the generator shafts, and the regulation is entirely by hand, aided by three annealed cast steel fly-wheels mounted on the opposite end of the generator shaft. These fly-wheels are 50 inches in diameter, 10½ inches face, and weigh 4,000 pounds. The water which is deflected downward by the cut-off device into the tail-race is received upon heavy cast iron baffle-plates and thence conveyed harmlessly away to the river. The wheels were manufactured by the Abner Doble Company, of San Francisco.

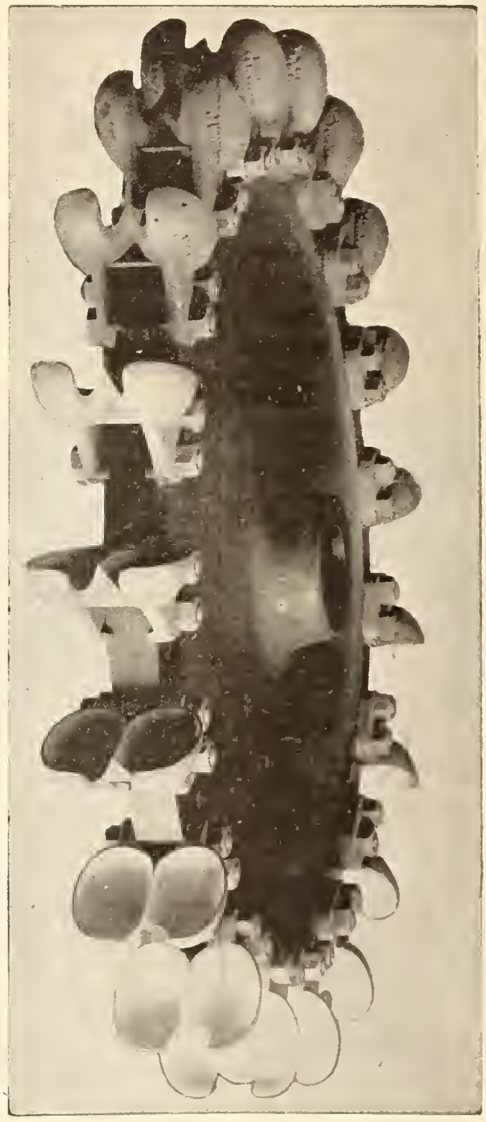

Fig. 2.—Dodle Ellipsoidal Water Wheel.

ELECTRICAL EQUIPMENT OF POWER HOUSE.

The electrical equipment consists of three Westinghouse three-phase alternating current generators, separately excited, slotted type, continuous winding armature, 450 k.w. each, 1,020 amperes, 440 volts, 7,200 alternations, with speed of 515 revolutions per minute. The illustration on first page is a view of the generators. The weight of each generator unit is over 40,000 pounds. Fourteen field poles are used, being separately excited by small direct current machines. The three generators give a normal capacity of 1,800 horse power. There are two belt-driven direct current generators of 15 k.w. each for exciters, which supply a current of 125 volts at a speed of 1,050 revolutions per minute. Each exciter has sufficient capacity to excite the two generators and is so located in the power house that it can be driven from either generator. There are four step-up Westinghouse transformers of 500 k.w. capacity each, of the oil-insulated, air-cooled type. These are three phase transformers of a primary voltage of 440, while the secondaries may be divided to deliver current at either 17,300 or 34,600 volts.

The switch-board consists of five marble panels all two inches thick and 65 inches high, four of them being 24 inches and one 36 inches wide, mounted on an iron frame. There is one exciter panel containing ammeters, two 3-pole single brake switches, two voltmeters, plug receptacles and pilot lamps. There are three generator panels, each containing one voltmeter, one ammeter, one voltmeter plug receptacle, one 3-pole quick-brake main switch, two field plug switches, one rheostat, synchronizer plugs and lamps and pilot lamp. The distribution panel contains two integrating watt-meters, three quick-brake double pole double-throw main switches, with interlocking device. From the generators and exciters all wires and cables are run under

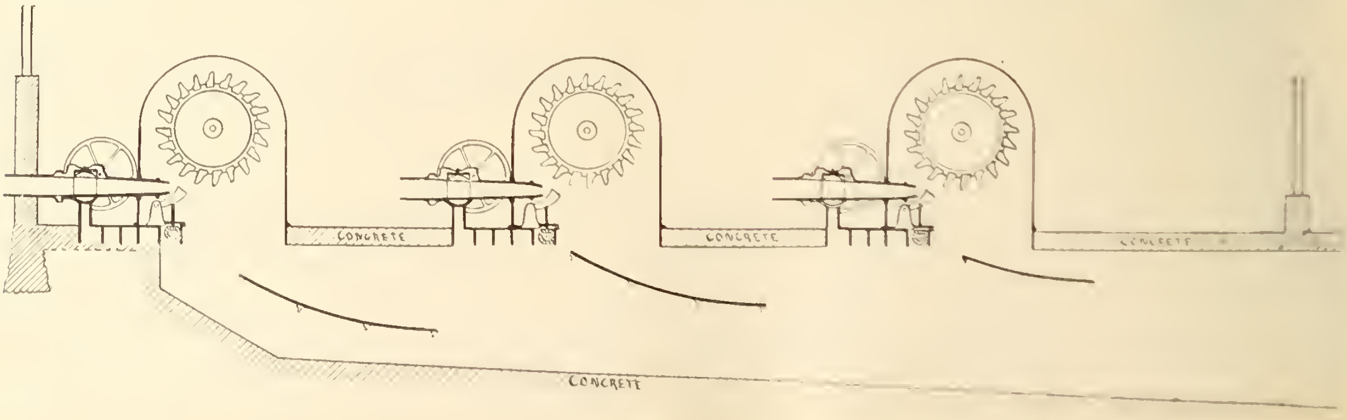

Fig. 3.—Vertical Section of Water Wheel, with Baffle-Plates and Tail-Race.

the floor in conduits to the switchboard and from there in same manner to the raising transformers. The method of distribution will be better understood by referring to Fig. 5. The secondary wires lead from the top of the transformers to the addition on the westerly side of the power house where the high-tension switches are arranged, by means of which the current is delivered to the transmission line. The high voltage current is then conducted to the lightning arrester house about 25 feet west from the power house. This building contains three lightning arrester units, each consisting of six choke-coils in series with the line and 30 arresters mounted on a marble slab.

THE POLE LINE.

From the lightning arrester house the current is delivered on to the transmission line, consisting of three medium copper wires No. 2 B. & S. gauge, arranged in in the form of an equilateral triangle, one wire being mounted at the top of the pole and the other two on a cross-arm of 3x4 Oregon pine. Eucalyptus pins, boiled in oil, are used to support the 7-inch tripple-petticoated glass insulators, which in turn support the transmission wires. The cross-arms are bolted to the poles and have a bolt through the ends to prevent splitting as well as to hold the pins in the arms. The top pin is secured by two nails driven through the iron band which is used to prevent the top of the pole from splitting.

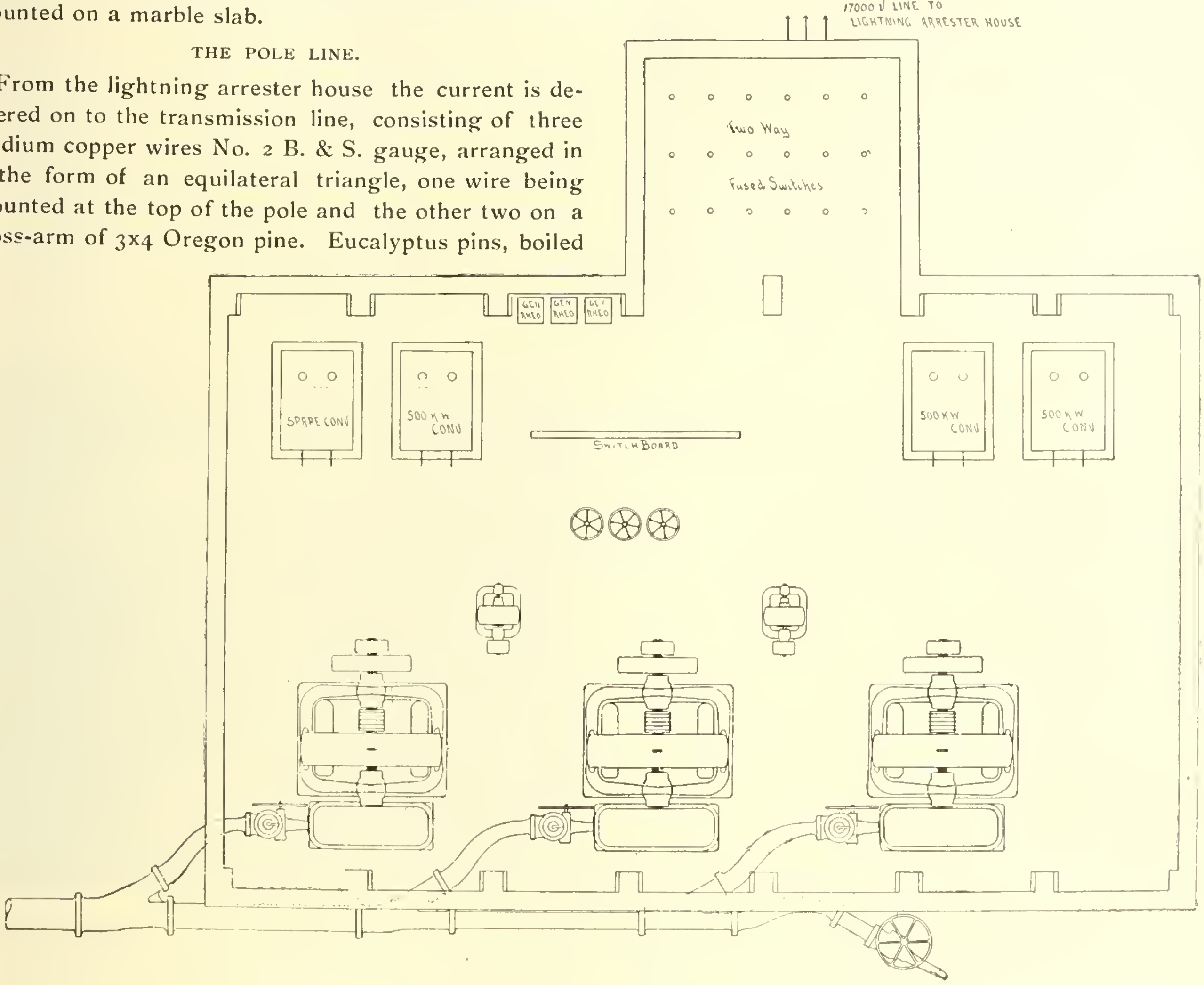

Fig. 4.—Ground Plan of Mount Whitney Power House.

About twenty-one miles from the power house the line is branched, one line going to Porterville, 21 miles distant, and the other via Visalia to Tulare, 20 miles distant. From the junction point to Visalia the wire is reduced in size to No. 5 B. & S. gauge and from Visalia to Tulare it is reduced to No. 6 B. & S. gauge. The total length of the line is 62 miles.

The poles are 26 feet long, 5x5 at the top and 9x9 at the bottom. For road crossings and in the towns their length is increased to 35 and 40 feet. The pole line is equipped with six pine cross-arms, 30 inches below the power circuit, for telephone purposes.

THE SUB-STATIONS.

Sub-stations have been established at Visalia, Tulare, Exeter, Lindsay and Porterville, each having a complete equipment of lightning arresters, high-tension fuse switches, step-down transformers, etc. Views of the interiors of the Visalia and Tulare sub-stations are shown in Figs. 8 and 9. The primaries of the step-down transformers are arranged with the coils divided in the centre for parallel or series connection, the same as the step-up transformers, for 15,000 or 30,000 volts, allowance being made for line drop. The secondaries have ten leads brought out, with terminal blocks, giving a range of from 1,930 to 2,280 volts, which is a valuable feature and has proven to be very satisfactory and useful, affording a ready means of changing the secondar. voltage to meet the requirements caused by changes in the proportions in the loads at the various sub-stations The transformers are of the Westinghouse oil-insulated, air-cooled type, in units of 50 kilowatts and 75 kilowatts, transforming from three-phase to two-phase, two transformers therefore constituting a "bank." The distribution of the light and power is at 2,000 volts, two-phase current.

The Visalia sub-station contains a 30-light arc machine for street lighting, driven by a 20 horse power induction motor, the incandescent lighting system being supplied direct from the 2,000 volt distribution and pole transformers to 104-volt secondaries. About 150 horse power is used from this station for lighting and a similar amount for operating induction motors for power purposes. In the Tulare station are two transformers of 75 k. w. each, and about 50 horse power is furnished to operate the water works and about 40 horse power for the local incandescent lighting system. The Lindsay station contains four transformers of 75 h. p. each, and furnishes 200 horse power for lighting and for operating pumping plants for irrigation, electric power having superseded steam and oil engines for driving the centrifugal pumps. The experience with the motors is said to have been satisfactory that many new installations are being contracted for. About 110 horse power is furnished by the Porterville station, in which there are installed four transformers of 50 k. w. each, also choke-coils and lightning arresters, the same as at the power house. In the Exeter station there are two transformers of 50 h. p. each.

The company has fixed the rate for current at $50 per horse power per year, delivered to the step-down transformers of the customer on his premises, measurement by wattmeter at transformer primaries.

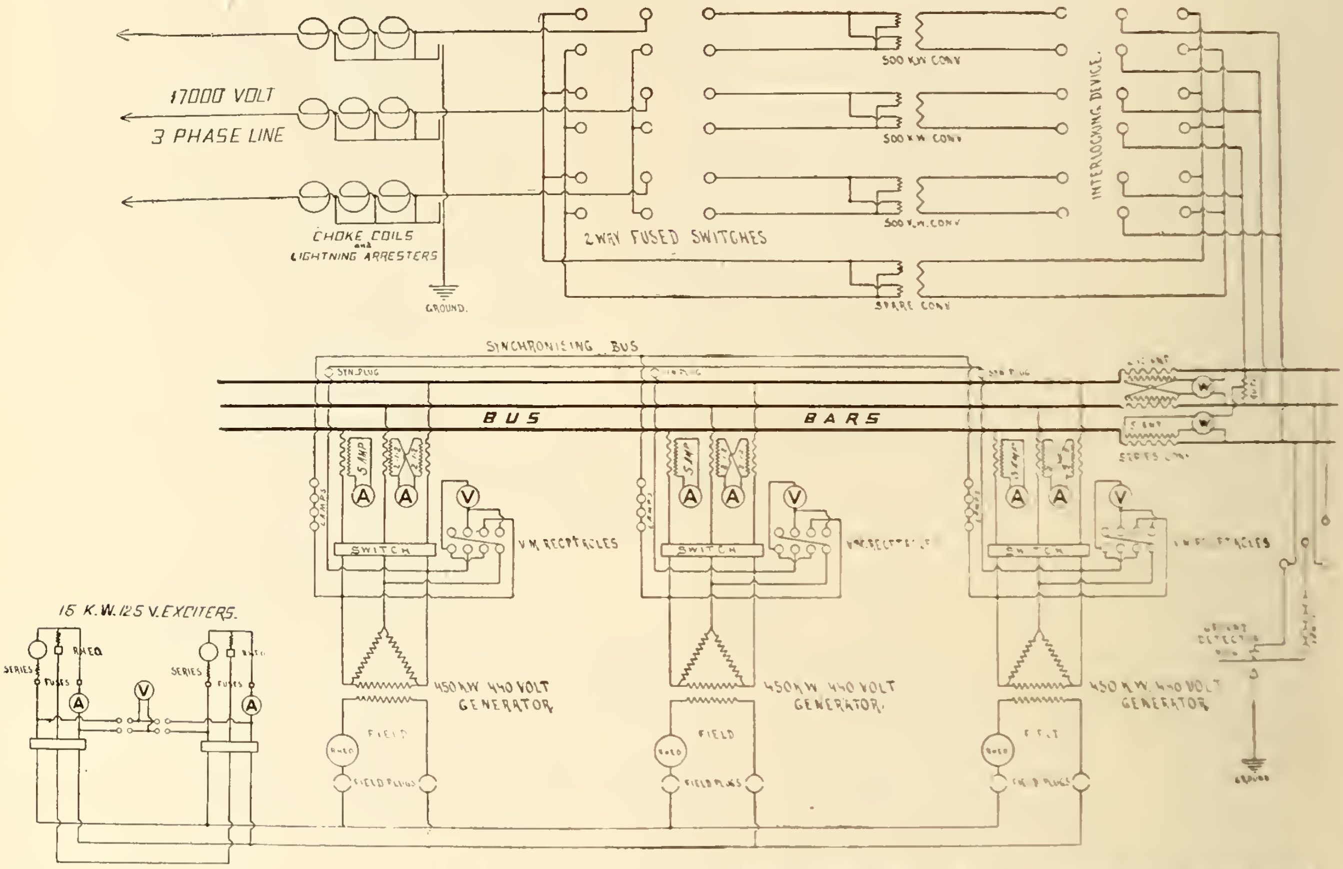

FIG. 5.—GENERAL WIRING SCHEME, SHOWING METHOD OF THROWING SPARE TRANSFORMER ON TO EITHER LEG OF TRANSFORMER.

The interesting features of the above plant are the high head used, the method of mounting the water wheel, armature and fly-wheel on a single set of bearings, and the fact that it is the first large electric transmission plant to be equipped with ellipsoidal water wheels. The means adopted for throwing a spare transformer into service in the event of either of the raising transformers at the power house becoming disabled is also a unique feature.

The entire electrical equipment of the Mount Whitney transmission plant was furnished and installed by the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa.

USE OF LOW CANDLE-POWER INCANDESCENT LAMPS.

W. M. STINE, in Western Electrician.

THIS article has to do with some of the minor economies that should be considered by those operating plants which do house-to-house lighting. Abroad it is customary to use for such lighting lamps of 8 or 10 candles, while in this country the usual practice leads to placing candles or even higher illuminating powers indiscriminately on all circuits without proper consideration for the service expected from them. The life of the lamp, too, is a consideration that is given much weight, the tendency being to place stress on considerable length of life, without regard to economy of operation.

When it is necessary to push house-to-house lighting on meter rates to obtain a paying station load and a sufficient return from a line, there is encountered a large class of patrons who are not able to use electric lighting in their homes unless it can compete closely with gas. The convenience of the electric light is conceded, but the persons to whom reference is made are not in position to pay for it. This class of business is desirable where the houses are near together and a sufficiently large number of patrons among them can be secured.

The average station manager pays too little attention to the satisfaction which his service is giving the small consumers; he is satisfied when the house is wired and the lamps are in place and the voltage well maintained. Then, again, a 16 or 25-candle lamp requires more energy to operate it, and the position is thoughtlessly taken that such lamps will yield larger monthly bills. On the part of the patron, however, after the novelty of the service has worn off, in the course of a few months, the amount of the lighting bill becomes of more consequence than the convenience of the service. Gradually a lamp is dispensed with in the hall, and others where least needed, and then, one lamp after another being replaced with oil or gas, the patronage of electric lighting is finally lost.

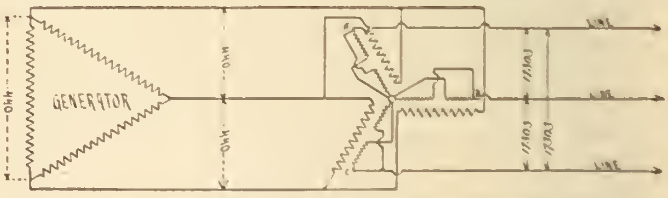

FIG. 6.—CONNECTIONS OF THE STEP-UP TRANSFORMERS.

This small house-to-house business can be made to pay and will succeed if the management is sufficiently enterprising. At the very outset, however, it must be conceded that the electric light bill must not greatly exceed an equivalent gas bill. The second concession must be that the patron's house shall be well lighted. In order to accomplish this, small light units are to be used operated at a high efficiency. In a small hall, for instance, a four candle-power lamp will yield sufficient illumination, and its maintenance will prove such a small item that patrons will keep lights of this size continuously lighted. Similarly, such small lamps can be used in closets, the cellar, and many places where but little light is needed. In this way the halls and passageways about the house will be well lighted and cheerful instead of dark and forbidding, as is usually the case in an electrically lighted house.

But it is especially in the living rooms that attention should be given to the size of the light unit. Here, too, the question of the quality of the light is of as great importance as its intensity. In many cases a 16-candle low-efficiency lamp is used, which proves a poor and an expensive light for reading from the fact that it yields a very yellow light. Then, too, in chandeliers, two or three 16-candle lamps are often used where equally good diffusion of the light and sufficiently intense illumination could be obtained by replacing these lamps with others of eight or ten candles.

Fig. 7.—Power House, Pole Line and Portion of Flume.

Coming to the main question at issue, economy and satisfactory service are secured for the patron by operating the lamps at a high efficiency. In spite of all that has been written on the subject, buyers of incandescent lamps still insist on great length of life. Though desirable in itself, in the present state of the art it should not be insisted upon.

An extreme case will be taken as an illustration. For reading purposes a 16 candle power light source is required. This admits of sufficiently intense illumination for comfortable reading at a distance of 7 or 8 feet. Bearing in mind that lamp-makers are obliged to gauge their product to a low efficiency standard to meet the demand for long life, the lamp in question will be considered to be operated at a much higher efficiency than its rating, which, it must be remembered, is in a sense arbitrary; and in this way one secures the desired whiteness of light and effects a great economy in its operation. By using a nominal 8 candle-power lamp at 50 volts on the circuit in question and operating it at a higher voltage there results:

	Volts.	Watts.
Lamp burning at 8 candles requires......	50	28
Lamp burning at 13 candles requires.....	55	34
Lamp burning at 15.5 candles requires....	56	36

If this lamp has replaced a nominal 16 candle power one at 55 watts, when it is operated at 55 volts and yielding 13 candles of white light it will prove as effective as the displaced yellow lighting. In point of economy the lighting is now done for 62 per cent. of the usual cost, or 23 watt hours are saved each hour it is in use. Taking the by-no-means uncommon meter charge of 0.02 cent for the watt hour, this saving for each hour amounts to 0.46 cent. At a cost of 20 cents for lamp renewals the cost of the lamp would be saved in 44 hours of use. It is well known that lamps operated at a high temperature will blacken quickly and rapidly lose in candle power. This is especially true of a black filament; but if a well flashed lamp of low emissivity and bright gray color of the filament is selected, thus operating it will give a useful life of at least 300 hours, though the writer has had some lamps to show a record of 500 to 800 useful lamp hours, when operated at this excess in pressure, before showing too great candle power drop.

Fig. 8.—Interior of Visalia Sub-Station.

Taking 300 hours, however, as the basis for renewals, the saving will pay for the renewal and leave a balance of $1.15 and for better light service. But it is possible to operate the lamp at 56 volts, thus getting the full 16 candle power equivalent, the cost in this case being about 65 per cent. of the normal 16 candle power lamp.

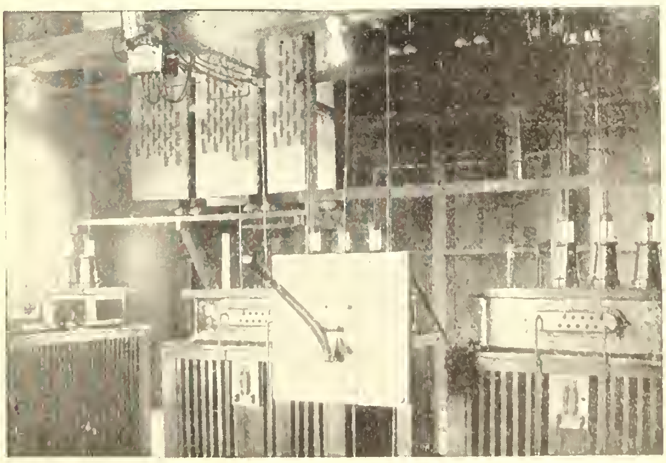

Fig. 9.—Interior of Portion of Lindsay Sub-Station.

This matter is one which calls for the exercise of intelligent care on the part of the manager of the plant. Some makes of lamps would not give good results under this treatment. It is emphasized that the filament must be well flashed and have a bright gray and polished appearance, and the exhaustion of the bulb must be thorough.

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Amendments to the Conmee Bill.

RECENT events in the Ontario Legislature have been fraught with more than usual interest for the electrical fraternity, inasmuch as several amendments to the Conmee Bill, passed at the session of 1899, were proposed. Some of the amendments were desirable, namely, those intended to improve the working of the Bill; some others, which changed in important respects the principles of the Bill, were objectionable. The Legislative Committee of the Canadian Electrical Association therefore felt called upon to take action to prevent the possible destruction of the usefulness of the Act, while, at the same time, it was prepared to aid in making the Act more workable. The Conmee Bill was attacked or affected from several directions, first, the Graham Bill; second, Mr. J. J. Foy's Bill; third, Dr. Bridgeland's Bill; and fourth, Mr. Lumsden's Bill. From the outset it was evident that the principal Bill was the Graham Bill, which contained some favorable and some unfavorable features. No purpose would be served by going into the details of the various clauses which would have affected the principles of the Conmee Bill; suffice to say that the objectionable features of the Bill were successfully opposed by the Legislative Committee, while, at the same time, the Committee supported other features of the Bill. The final outcome was the adoption of the following amendments, namely, to give municipalities the option of making the principal and interest of their debentures payable in equal annual instalments, as well as of making the debentures payable by means of a sinking fund, as in the original bill; to allow municipalities three months, instead of one, to withdraw from their offer or reject an award for the taking over of a plant; to make it optional for a municipality and a company to agree on a single arbitrator other than the official arbitrator. These amendments, it is admitted, will improve the workableness of, and facilitate procedure under, the Conmee Bill. The provision to allow municipalities three month's time to reject their offer or an award will place corporations in a position to submit the question to a vote of the municipal electors. Mr. Foy's Bill proposed to exempt the city of Toronto from the operations of the Conmee Bill. This measure was defeated in the Municipal Committee. The object of Dr. Bridgeland's Bill was to give authority to municipalities which develop water powers to dispose of surplus current for furnishing power. This was in part opposed by the Legislative Committee. The Legislature finally accepted Dr. Bridgeland's Bill, with some modifications. The design of Mr. Lumsdem's Bill was to repeal the Conmee Act, but its reception was not favorable, a second reading being unanimously refused in the House.

Reverting to the Conmee Bill, the feeling of the members of the House seemed to be that the legislation had not been given a fair trial, and that it would be unreasonable to alter the vital principles of the Bill until this had been done. It is a matter of congratulation that the Legislature has again approved, with practical unanimity, of the justice and fairness, both to municipalities and companies, of the principles of the Conmee Bill. The opposition encountered can scarcely be considered as antagonistic, inasmuch as the author of the Graham bill pronounced himself to be in sympathy with the leading principles involved in the Conmee Act. He frankly stated that the object of his Bill was to improve the working of the Conmee Bill and to make certain parts of it more clear. Nor can it be said that the members of municipal corporations are generally opposed to the measure. The municipal authorities apparently believed that its operation could be improved, but they did not seek to oppose the Bill itself. It is possible that in the future experience may suggest further amendments which may be made with advantage to all concerned. It might be pointed out that it is manifestly in the interests of electric lighting companies, not to place obstacles in the path of the Conmee Bill, but as far as possible to assist in facilitating its proper working, for, while the valuation clauses of the Bill will give the companies merely the barest actual value for their plant, and that without profits, yet, in the event of a municipality purchasing, that is better for the companies than leaving their property exposed, as under the former law, to ruin without compensation. Municipalities are not showing antagonism to the Conmee Bill, and nothing can be accomplished by companies pursuing a policy of antagonism to the municipalities. When a company is approached by a municipality with a view to the purchase of its plant, we believe it is advisable to deal with the offer in a fair, business-like spirit, and to throw no technical obstacles in the way of an amicable and equitable arrangement.

The electric lighting interests of the province are deeply indebted to the Canadian Electrical Association for the attention it has given to the legislation in question. The Legislative Committee has now become an important section of the Association. Although the work of this committee has been accomplished within two years, yet in this brief period legislation has been enacted which, while it does no injustice to municipalities, prevents the property of lighting companies from being exposed to confiscation. The benefits of the efforts of the Association do not accrue to its members only, but every lighting company in the province is placed under its protection. The Association is, therefore, deserving of hearty support.

Electricity in Mining.

In its application to mining purposes electricity enters upon perhaps the most exacting and varied field which it is possible to conceive of, as all classes of transportation and haulage make their very exacting demands, and the applications to lighting, power for fans, drills, compressors, pumps, cutters, etc., are certainly wide enough to provide scope for all classes of apparatus. If, then, in this comprehensive field of application there still remain a few demands which electricity does not fill in an entirely satisfactory way at present, the reason will probably be found in the fact that these applications have been somewhat neglected by an art which has had such tremendous fields open to it in other directions. However, the fact remains that within a few years nearly every application of power to mining work has been successfully met by electric power, and a review of the situation at the present should prove to be both interesting and instructive.

The field invaded by electric power had been held, up till its advent, by steam and compressed air. The steam engine being a prime mover, still holds its place for developing the power, and must of necessity continue to do so unless superseded in certain cases by water wheels or gas engines, but in the transmission, distribution and application of the power developed by the prime mover, the steam, compressed air, and electricity are directly comparable. Steam distribution will obviously only be used where steam is the prime mover, while in the case of water power or gas the distribution will be by means of air or electricity. The question of gas engines for power generation in certain localities where the cost of coal is excessive is receiving attention, owing to the better heat efficiency of the gas engine and the value of the by-products of the gas manufacture. But in most mines economy is not the first consideration. Even in this case, however, the obvious advantages of electricity will render its use for lighting almost imperative.

The power demands for mining purposes may be generally grouped in four divisions, lighting, traction and haulage, power for fans, pumps, etc., and for drills and cutters. So far as lighting is concerned, no question can arise as to the superior advantages of electricity, its flexibility, safety in gassy mines, coolness, and freedom from flame and simplicity of transmission rendering it incomparably better than any other form of illuminant. With regard to traction and haulage, its only rivals are that ancient motor, the mule and cable traction. The first will probably always find a place in the workings in the vicinity of the faces being operated upon, while the rope and electric traction compete for the haulage of trains in the tunnels and outer works. Without dealing in detail with the advantages of electric over rope haulage, it may be pointed out that in the modern mine the former is almost exclusively occupying the field, except in cases where excessive grades render cable traction a necessity, and even in these cases electric motors are available for driving the cable drums. It is in its application to the general power demands for pumps, fans, hoisting, etc., that the flexibility and readiness of application of electric power becomes overwhelmingly apparent, allowing as it does the establishment of motors in out of the way places, and permitting its use for temporary demands without excessive installation costs, and also the ability to manipulate the apparatus from a distance is often of great value. No better illustration of the use of electric power for these purposes can be had than that afforded by an inspection of the camp at Rossland, where power is supplied from a distance of thirty-one miles by the West Kootenay Power and Light Company, and applied by means of about three thousand horse power in motors to the mines in the vicinity. Among the most striking applications in this camp is that for hoisting. Several hoists are in operation, the largest being driven by a three hundred horse power motor, raising ore from a 750 foot level. The motor is a three phase induction machine, directly connected to a double drum hoist capable of raising eight tons at a speed of 700 feet per minute. In connection with the same mine a compresser is driven by a 400 h.p. three phase synchronous motor. In other mines in Rossland similar but smaller machinery is used for the same and many other purposes, and the regulation on the lighting circuits is remarkably good when the effect is considered of so large a motor load with such variable demands as hoisting at the end of a thirty-one mile transmission line.

It is in the use of electricity for the operation of drills, coal cutters, etc., that questions may arise as to its value as compared with other powers. So far as the transmission is concerned, it still retains its superiority, and also as regards its flexibility and general simplicity, but, although in electric drills great advances have been made since their first application, the air drill still holds its own. It should be remembered, however, that not all of the favor with which the air drill is regarded is due to its superiority as a mechanism, but to the personal consideration that the exhaust from the drills furnishes fresh air to the workings, which it is practically impossible to obtain in such places by the general ventilating system. Further than this, consideration must be paid to the conservatism of the miner who is used to the vagaries of the air drill and who does not generally relish the acquiring of any fresh knowledge of newer apparatus, especially when it does not add to his comfort under conditions which are trying at the best. The electric drills in use may be divided into rotary and reciprocating types. The first, by reason of the direct application of motors, appears to present fewer difficulties in construction, while the latter, in attempting to imitate the percussion drill by the direct attraction of solenoids, introduce trouble of its own which it may be safely said have not been overcome up to the present. Again, the more successful of the latter class require the use of special electrical generators giving suitable current waves which cannot be used for the general power distribution. It short, the drilling appears to be largely in the hands of the air drill at the present time, in spite of many attempts to displace it, and in view of past experience the outlook is not at present very hopeful for electric drilling. As regards coal cutters, which are of considerable variety, electricity, owing to its flexibility and simplicity, can be very readily applied with success, and failures of the cutting apparatus, which have been pretty frequent in the past, cannot be laid to its charge. Several successful types of electrically driven cutters are at present in the market, and as one machine with two operators will displace from twenty to thirty men on the coal face, these will inevitably be more generally applied. The chief objection which is made to the use of cutters is due to the fact that, with the methods of laying out the coal faces which are adopted for hand cutting, machine cutting brings down the coal in such quantities that it cannot be carried away quickly enough, thus limiting the possible output of the machine.

The most desirable system of generation and distribution of electricity will obviously be one which will lend itself best to the general requirements, and as it may not be possible to meet each of the separate demands in the best manner with one system, a compromise may have to be made, giving first consideration to the most important. For flexibility, an alternating system will appeal to the engineer in most cases, and owing to improvements in motors operated on this system, every requirement for mining work can be met with the exception of traction and some forms of drills. At the present direct current haulage holds the field, chiefly because the alternating motor has not been designed to meet the conditions imposed by mining traction, and also because the phased currents adopted require a double trolley line, which in the narrow and low tunnels would be prohibited, from its complication and danger. The latter appears to be the greater difficulty, as the application of alternating current motors to traction purposes appears to be solved for surface tramways, and the special application to mining work should present no insuperable difficulties. In many cases a direct current plant and distribution (which will be suitable for all purposes) can be used where the distances are not great and where no motors are to be located in gassy parts of the mines, but in general the low distribution voltage imposed by mining work heavily handicaps the direct current. In any case, for all mining purposes, except traction, the alternating current motor is more simple and reliable than the direct current, chiefly owing to the fact that no commutator is required which may flash, become dirty and require cleaning, which no mining motor ever gets. It appears probable that the alternating current systems will prevail finally for all purposes, but at the present a composite plant giving alternating and direct currents appears to be necessary if electric traction be required. This, however, is not so complicated as it looks, for with double current generators in the station either direct or alternating current can be had without complicating the plant. As regards the distribution of power, owing to the adverse conditions which prevail in mining work underground, a potential of more than 270 volts is not advisable on trolley wires which are within possible reach or on motors and other appliances which are to be handled. Owing to the dampness and presence of destructive minerals in the water, which is generally in evidence, insulations are rapidly corroded unless thoroughly protected, and it appears advisable in many cases to adopt bare wires thoroughly insulated from ground and each other by non-corrodable supports for the low voltage wiring, and armoured cables laid in dry places and out of reach for the transmission lines. The use of iron piping through which the cables can be drawn is usual in shafts and places where injury might occur through falling materials. In gassy mines safety cables are sometimes used which are designed so that the circuit is opened at the switchboard in case the cable is cut by falling rocks, so that no arc is formed in the mine. These generally require some form of supplementary circuit, which is objectionable, and it appears that ordinary concentric cables should meet the conditions of safety when it is considered that it is almost impossible to cut one of these without short-circuiting the cable, which would open the circuit-breaker in the station. In gassy mines, of course, gas tight or oil switches are used, and machines with commutators present more elements of danger than those without.

Summing up the advantages and disadvantages of electricity, steam and air, it may be said that steam distribution and utilization is expensive to install and maintain, is inefficient by reason of radiation and condensation, requires provision to be made for exhaust steam, heats up the mine, and rots the timbering. Air transmission and utilization of power is greatly superior to steam, and is generally used, but pipe lines are expensive to install, their deterioration is great, and there is not the requisite flexibility to meet the temporary character of the installations in the workings. Further, both of the above systems must be supplemented by an electric lighting plant. Electricity for mining purposes possesses in a remarkable degree the necessary flexibility and adaptability to meet the conditions. Maintenance is small, the attendance required is slight, and the same plant is used for the lighting as for the power requirements. The drill situation, however, is not altogether satisfactory, but the time for development of that particular application has been short, and there is good reason to think that the advantages of electric power for all purposes will soon improve that application and make it thoroughly satisfactory.

MR. JULES BOURBONNIERE.

The features of Mr. Jules Bourbonniere, manager and secretary of the Imperial Electric Light Company of Montreal, are portrayed on this page. Mr. Bourbonniere graduated with distinction from the Catholic Commercial Academy in Montreal in the year 1884, and immediately thereafter engaged as bookkeeper with the firm of Mailloux & Barsalou, wholesale hardware, Montreal, which position he occupied for four years. He then became manager, for two years, of Alfred Truteau's biscuit factory, and after spending two years as secretary-treasurer of the Farnham Beet Root Sugar Company (Baron Seillieres) at Farnham, Que., undertook the management of Israel Charbonneau's sash and door factory at Mile End, a suburb of Montreal.

In May, 1894, Mr. Bourbonniere entered the services of the St. Jean Baptiste Electric Company, of Montreal, as chief accountant and secretary. When the St. Jean Baptiste Electric Company was re-organized, in December, 1895, he was entrusted with the dual functions of manager and secretary of the new organization, called the Imperial Electric Light Company, which position he still retains. The above company, judging by its annual dividends, is prospering financially, and claims to have a monopoly of commercial lighting in Eastern Montreal. Mr. Bourbonniere is only 31 years of age. He is married, and has a family of three future electricians.

Mr. Jules Bourbonniere.

It is whispered that Mr. Bourbonniere has been offered the management of a large water power plant. We shall be pleased to learn of his continued success.

NEW INCANDESCENT LAMP.

Edison has brought out a new incandescent electric lamp for high tension currents. It is made of a mixture of rare earths in a porous form, with carbon dust. The current, under the high pressure, leaps from particle to particle of the carbon dust. The earth used is thoria or zirconia, and the whole is dipped in a solution of acetate of thoria, so as to make a coating which shall incandesce brightly when the whole filament is brought to a high temperature by the action of the current. He also makes filaments by impregnating a thread of cotton wool, carbonising it, and then thickening the coating of oxide on it.

COST OF ELECTRICITY IN BUILDINGS.

It is generally assumed that electricity can be supplied to buildings more cheaply than it can be generated by isolated plants, but that this is not always the case is shown, says the Engineering Magazine, in a carefully prepared paper read before the American Institute of Electrical Engineers by Mr. Percival R. Moses.

Mr. Moses has collected information from more than a hundred buildings of various sizes and types, and from these he has selected those from which the information was furnished with such a degree of detail as to render the conclusions reliable. The buildings selected include hotels, office buildings, loft buildings, department stores, and apartment houses, all in the city of New York, and since liberal access to the books of the establishments was permitted the data are of much interest.

In the investigation of the buildings the hourly variations in the demand for light and power were plotted in the form of curves, and in each case a proportional allowance made for depreciation, interest, and other fixed charges. A typical building was taken in each case, and as these cases include actual records of the cost of supplying the same buildings, under the same conditions, with electricity, both from their own isolated plants and by the central station, it certainly appears as if the comparisons have been made upon a fair basis.

In considering the isolated plant it must be remembered that in nearly, if not all, such buildings a steam power plant must be maintained in any case, or at least steam must be used for heating, and if the steam power does not provide sufficient exhaust steam to warm the building, live steam must be used. The installation of an isolated electrical plant is therefore only a partial increase in operating expense, in such cases, and not so great as it would be if the entire power plant had to be placed solely for the operation of the electric machinery.

We give here only the conclusions which Mr. Moses draws from each building considered by him, and the full data in each case will be found in his original paper. Taking a table which Mr. Moses has prepared for buildings using approximately from 825,000 kilowatt-hours per annum down to 40,000 kilowatt-hours, he shows that the costs per kilowatt-hour for isolated plants are as follows :

Large Hotel	1.66 cents
Small Hotel	2.45 "
Apartments	4.70 "
Department Store	2.85 "
Small Store	4.10 "
Large Office Building	4.37 "
Small Office Building	5.06 "
Loft Building	2.60 "

When it is understood that the charges by the central station company, taken from the published reports, are, on an average, 10.6 cents per kilowatt-hour, and that the cost of production is about half this, it appears that under existing conditions in New York the private consumer can generate electricity at about the same cost, or even less cost than the central company, and that there is a manifest economy in the installation of the isolated electric plant.

The Lachine Rapids Hydraulic and Land Co. has within the last three months installed four generators from the works of the Canadian General Electric Co., Peterboro. These will increase the capacity of the plant by 4,000 h. p. The Lachine Company have recently made some changes in the method of driving the exciters at the power house, they now being driven by independent wheels.

THE GAS ENGINE VS. THE STEAM ENGINE.

A LEADING manufacturer of both gas and steam engines holds the opinion that a correct answer to the question, what is the comparative cost of operating a gas engine and a steam engine of equal power, involves a special solution for each individual problem. He says: Considered solely as a machine for converting the total energy of the fuel into mechanical work, the gas engine is far the more efficient. There are gas engines in operation which transform over 25 per cent. of the heat in the fuel into useful work, while in the very best recorded performance of the steam engine barely 14 per cent. of the energy in the coal burned has been thus accounted for, and in the average steam plant, not to exceed 5 per cent. There are many small plants, consisting of common slide valve engines, with uneconomical types of boilers, in which less than 2 per cent. of the energy of the coal burned is converted into mechanical work. At the same time it must be remembered that a given number of heat units in the form of fuel suitable for use in a gas engine costs more than an equal number in the shape of coal or other ordinary fuel suitable for burning in a common boiler furnace. As a general proposition it may be assumed that in a plant which operates continuously the item of fuel alone will be somewhat greater for the gas engine than for an improved type of modern steam engine, except possibly in the case of an engine running on producer gas. When the service is of an intermittent nature, or the power is required only for a comparatively short time each day, this difference in favor of the steam engine becomes less, and may even become a balance in favor of the gas engine, for the reason that in the gas engine plant there are no ‘ stand-by losses,’ i.e., radiation and leakage when standing idle under full steam pressure, and coal burned in banking fires and raising steam. With the gas engine the fuel expense starts and stops with the engine. But the fuel cost is only one item in the cost of producing power. One must consider the value of the additional space and buildings required for a boiler plant; the cost of a stack; depreciation, repairs and insurance on a boiler plant. The gas engine has a field of its own which cannot be occupied by the steam engine, and there is no immediate prospect of the gas engine seriously encroaching on the legitimate field of the steam engine.

The Sherbrooke Gas and Electric Co., Sherbrooke, Que., are increasing their station capacity, and have placed an order with the Royal Electric Co., of Montreal, for a 500 k.w. S.K.C. two phase inductor type generator.

A unique blotter has been sent out bearing the compliments of Messrs. Sadler & Haworth, manufacturers of oak tanned leather belting, Toronto and Montreal. The blotters are held together by a celluloid button bearing an illustration of the Union Jack, while the name of the firm is inscribed on a fine sheet of celluloid covering the blotters.

THE VOLTA STORAGE BATTERY.

THE following description of the Volta storage battery is found in the prospectus of the Volta Electric Storage Company, of Hamilton, an illustration of whose works is presented herewith:

The problem of intercepting and retaining electrical energy is receiving its latest and fullest development in the adaptation of the original pile of Volta to the purpose of storage. Of course, the suggestion carries with it the necessity of upsetting and rearranging our ideas of storage battery coustruction. The excess of sulphuric acid electrolyte must go, but with it goes unnecessary weight, and one of the greatest inducements to sulphating that any cell arrangement can offer to the lead plates or grids. The containing sell must go, but with it goes also weight and space. The knowledge that a single plate may be an element must come, but with it comes the greatest possible compactness, and also an unlimited flexibility of application to all purposes for which electrical energy can be applied. The facility with which this metallic plate construction of Volta lends itself to the necessary variations required for the purpose of storage is remarkable. In fact, it largely consists in the constructing of the reservoir. The porous lead as applied is the analogue of the zinc, and the lead plate that of the copper, or the conducting side of the disk. It only remains, therefore, to increase the capacity of the porous lead so as to absorb more hydrogen, and to add the peroxide to the face of the opposite side of the sheet lead, to enable it to absorb more oxygen; and then to place between contiguous plates a moisture-absorbing material of sufficient capacity to furnish the electrolyte for producing the gases; and the thing is accomplished. Theoretically, therefore, we should expect to find more electrical energy per 100 lbs. of weight carried, and per cubic foot of space occupied, in such a reservoir than in one constructed on the plan of Plante and Faure, or in any other variation of the two volt Plante type.

WORKS OF THE VOLTA ELECTRIC STORAGE CO., HAMILTON, ONT.

An inspection of the accompanying illustrations will serve to certify us that the theoretical presumption is well borne out by facts. In the first place, there is no containing cell used in this high tension construction, whereas in the Plante there must be one containing cell for every two volt element. This containing cell, of course, must be greater than the mere superfices of the element; and we also know that this space must be filled with electrolyte. This combination increases both space and weight. Again, in each cell of the Plante type, there must be two lead terminals, carried well up above the surface of the acid, taking up still further space. In the high tension pile, on the other hand, these are eliminated; there being but two terminals even should the potential of the pile be carried to 100 or more volts. In the illustration shown the normal potential is 28 volts, while there are but two terminals—one from the bottom plate, "the positive," and one from the top plate, "the negative." The path of the charging current is from the positive up, directly through the pile to the negative. This pile.

with an energy capacity of 100 ampere hours, and 28 volts normal potential, is contained in a space 11½ inches wide by 28 inches in length and 11 inches in height, equal to a little more than two cubic feet, for approximately four h. p. hours of energy, and with a weight of 240 lbs. total, or one h.p. for every 60 lbs. of weight carried. Where piles are built in larger units, both weight and space are reduced still further. Four such, piles occupying a space 28 inches wide by 44 inches long and 11 inches high will furnish current for twelve 16 candle-power 110 volt lamps for 15 hours. In other words, a space 28 inches wide and less than four feet long and 12 inches high will furnish sufficient room for holding a battery to light an ordinary building burning 12 lamps 5 nights of 3 hours each. The cost also, in proportion to ordinary storage plants, is very greatly reduced, such a plant costing the user $240.

The accompanying plates show two curves, Fig. 2 representing the drop in potential of a single plate, or element, of this size during a discharge of 100 ampere hours, at a 7 ampere rate; the second, Fig. 3, representing a curve for the entire pile during the same discharge, showing a drop of 2 8/10 volts for the entire pile, or 2/10 per plate or element. This cut also shows the kinetic value of the pile in h. p. hours.

Among the noteworthy peculiarities of the high tension pile is, first, the fact that each plate is an element in itself, having a positive condition on one side of the plate and a negative condition on the other side, for the potential difference in a plate at full charge of 2 2/10 volts from the surface of the positive active material to the surface of the negative active material. When, therefore, in a well constructed pile the circuit is disconnected, that is, the outside circuit unclosed, it is an impossibility to discharge a single plate, because the points of potential difference are separated by the metal plate, a solid septum through which the necessary translation of ions is impossible. When, however, the outside circuit is closed, then the potential difference is along the line of that circuit from the positive terminal of the pile to its negative, and the electrical action and molecular interchange is between the opposite sides of adjacent plates. Antoher peculiarity of this battery is that the fumes, which are an unavoidable and never failing attendant upon the Plante type of battery, compelling its installation in separate and specially prepared apartments, and often at great expense, are entirely absent, so that it is practicable to set it up in a machine shop, or even a living room without injurious results to person or property. The value of this last feature cannot be overestimated, and taken in connection with its great compactness, its comparatively light weight and its small cost, it completes the list of desirable qualities which go to make up the perfect storage plant for the markets of the world.

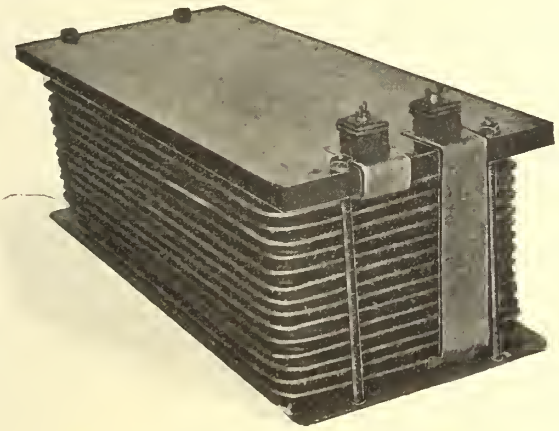


FIG. 1.—THE VOLTA STORAGE BATTERY.

The Volta Electric Storage Co., Ltd., of Hamilton, Canada, are introducing these batteries for all such uses as indicated above, and for every other purpose for which electric current can be utilized. They are just now moving into their new building, from which they expect to supply the Dominion of Canada and also do a large export business.

Articles of incorporation have been filed for a company which purposes operating electric and steam railways in Cuba. This company has a capital of $8,000,000, and one of the chief promoters is Sir William Van Horne.

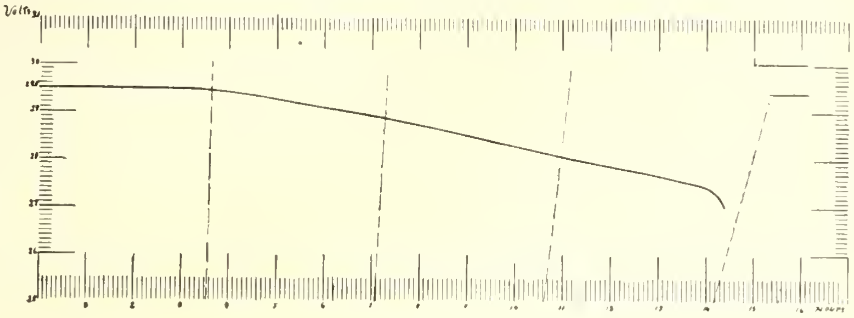


FIG. 2.

H. Walker & Sons, of Walkerville, Ont., have given a contract to the Michigan Electrical Co., of Detroit, for what is expected to be the most elaborate sign on the American continent. For the purposes of the sign, a separate iron structure on the river front, in rear of the offices of the firm, is being built. Between 4,000 and 5,000 four-candle power incandescent lights will be used. The letters will be clear, while colored lights will be shown in the border. It is estimated that 100 h.p. will be required to operate the lights.

An exhibition will be made in the Art Museum within a week or so of the result of work done by local students in the International Correspondence School of Scranton, Pa. This exhibition will be of special interest to local people, showing how far comparatively uneducated people may progress by improving spare moments in the study of lines of work in which they desire to perfect themselves. The Correspondence Schools interested in this exhibition have a remarkable following in this city, over 600 persons being enrolled as students here. The work covers almost every line in which working people are interested. An ambitious young man who has been forced to slight his common school education, turns to the courses offered by these schools, and, selecting the one in which he is most interested, begins the study. The plan of the courses pre-supposes only the ability to read and write. The first work is elementary, and the progress is gradual and possible only by becoming perfect in what has preceded. The student goes through the course, and at such a time as he completes the work receives a diploma, and the management of the schools is also interested in securing for the graduate better employment in keeping with his proficiency. The exhibition is made in the Art Museum at the suggestion of the City Library Association. In connection with the drawings, which will be largely of mechanical and architectural designs, the city library will have several shelves of books that are useful for reference in connection with the course given by the schools. It is hoped that those pursuing the studies may be interested in coming more frequently to the library.—Springfield Republican, March 26, 1900.

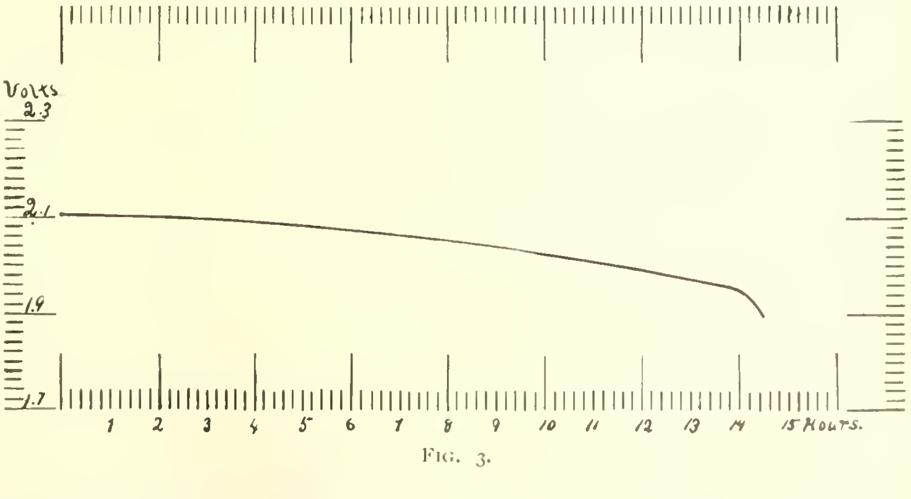


FIG. 3.

COKE AS A STEAM FUEL.

THE advantages of coke over coal as a fuel for generating steam were discussed at the Montreal meeting of the Cotton Manufacturers' Association by Arthur C. Freeman, of Waltham, Mass., who offered the following suggestions as useful in learning its management :

(1). In building the fire, put the coke on lightly and often, until the fire is 7 or 8 inches thick ; an 8-inch fire will make steam much better than a heavier one.

(2). It is better not to disturb the top of a coke fire, therefore when firing spread the fuel evenly, so as to keep the fire level.

(3). Shaking bars are very suitable for burning coke, and they should be shaken frequently. If dead bars are used, a light poker should be run under the fire frequently to keep clinkers from clinging to the grate, and to keep them broken up. A poker is better than a slice bar for this purpose, as it is lighter and more easily handled. The object is not to bar up the fire, but to detach small pieces of clinker and prevent them from forming and running together.

(4). It is advisable to keep water in the ash pit, or to introduce a jet of steam.

In support of his position, Mr. Freeman presented the result of a test made by the Mutual Boiler Insurance Company of Boston on the comparative evaporative powers of coals and coke compared with the best soft coals.

FRICTION ON STEAM PACKINGS.

BEFORE the meeting of the American Society of Mechanical Engineers in December, 1899, Mr. C. H. Benjamin, of Cleveland, Ohio, read a paper on the above subject, describing some experiments made at the Case school with several varieties of packings. He gives four tables showing the results, which we reproduce, together with his comment and general conclusions.

Table I gives a summary of the results, showing the average horse-power consumed by each packing box at varying pressures, and, for purpose of comparison, the power at 50 pounds pressure of steam. The friction of the machine has been reducted.

Table II shows the effect of tightening the gland nuts on the friction of the packing, and also the effect of oiling the rod.

In most of the experiments detailed in Table I the nuts were tightened with the fingers only, and then just enough to prevent leakage, and no lubricant was used except that incorporated in the packing itself. With some of the dry rubber packings it was necessary to use oil from the first. A good quality of cylinder oil was applied.

The effect of varying the steam pressure is best shown graphically, as in Tables III and IV. The numbers at the ends of the lines correspond to numbers used in the the other tables. The ordinates indicate the steam pressures observed, while the abscissas represent the horse-power cosnumed by each box. The points where these lines cut the line of 50 pounds pressure are those used for comparison of the different packings. It will be seen that the friction varies with the pressure in approximately straight line ratios in many of the cases.

GENERAL CONCLUSIONS.

1. That the softer rubber and graphite packings, which are self-adjusting and self-lubricating, as in Nos. 2, 3, 7, 8, and 11, consume less power than the harder varieties. No. 17, the old braided flax style, gave very good results.

2. That oiling the rod will reduce the friction with any packing.

3. That there is almost no limit to the loss caused by the injudicious use of the monkey-wrench.

4. That the power loss varies almost directly with the steam pressure in the harder varieties, while it is approximately constant with the softer kinds.

The diameter of rod used—two inches—would be appropriate for engines of from 50 to 100 horse-power. The piston speed was about 140 feet per minute in the experiments, and the horse power varied from .036 to .400 at 50 pounds steam pressure, with a safe average for the softer class of packings of .07 horse-power.

At a piston speed of 600 feet per minute, the same friction would give a loss of from .154 to 1.71 with a working average of .30 horse-power, at a mean steam pressure of 50 pounds.

TABLE I.

Kind o Packing.	No. of Trials.	Total Time of Run in Minutes.	Average Horse-Power Consumed by Each Box.	Horse-Power Consumed at 50 Pounds Pressure.	Remarks on Leakage, etc.
1	5	22	.091	.085	Moderate leakage.
2	8	40	.049	.048	Easily adjusted : slight leakage.
3	5	25	.037	.036	Considerable leakage.
4	5	25	.159	.176	Leaked badly.
5	5	25	.095	.081	Oiling necessary ; leaked badly.
6	5	25	.368	.400	Moderate leakage.
7	5	25	.067	.067	Easily adjusted and no leakage
8	5	25	. 82	.082	Very satisfactory ; slight leakage.
9	3	15	.200	.182	Moderate leakage.
10	3	..	.275	....	Excessive leakage.
11	5	25	.157	.172	Moderate leakage.
12	5	25	.266	.330	" "
13	5	25	.162	.230	No leakage ; oiling necessary.
14	5	25	.176	.276	Moderate leakage ; oiling necessary.
15	5	25	.233	.255	Difficult to adjust ; no leakage.
16	5	25	.292	.210	Oiling necessary ; no leakage.
17	5	25	.128	.084	No leakage.

TABLE II.

Kind of Packing.	Horse-power consumed by each box, when pressure was applied to Gland Nuts by a 7-inch wrench.						Horse-power before and after oiling rod.	
	5 Pounds.	8 Pounds.	10 Pounds.	12 Pounds.	14 Pounds.	16 Pounds.	Dry.	Oiled.
1	.120	....	.136					
3	...	....	. .	....	.	...	.055	.021
4	....	.248	....	.303	....	.390	.154	.123
5	....	.220						
6	....	.348	.430	..		...	.373	194
7	....	.126	.228	.2 0	230	340	.067	.053
8	...	.363	.500	.535	.570	.533	.533	.236
9	....	.166	....		. . .		.666	636
11	....	.405	.454	....	....		454	[illegible]
12	....	.161	.242	359	.454		454	122
13	...	.317	.394	.582				
15	...	.526						
16	....	.377	.860					
17	-.	.198	.277	.380				

TABLE III.

VARYING STEAM PRESSURE

SCALE 1 INCH = 0.1 H. P.

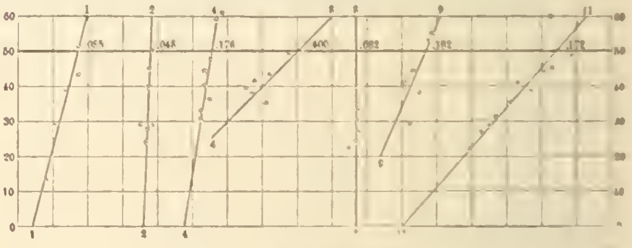
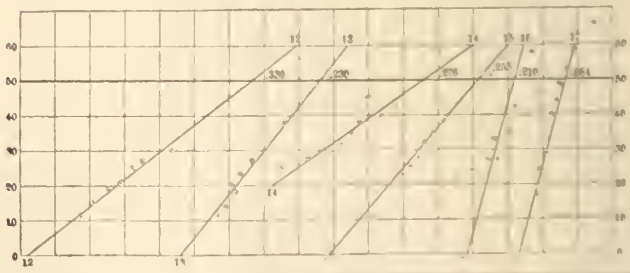


TABLE IV.

VARYING STEAM PRESSURE

SCALE 1 INCH = 0.1 H. P.



Mr. W. T. Steward, E.E., of Toronto, has furnished the town council of Woodstock, Ont., with a valuation of the electric light plant there, also an estimate of the cost of the installation of new and up-to-date machinery. The council contemplate municipal ownership and the remodelling of the plant.

THE DEVELOPMENT OF INTERIOR CONDUIT.

A FEW years ago saw the advent of iron electrical conduit; and while the welcome extended was not enthusiastic, yet the superiority of the tube over the asphaltic paper raceway was so manifest that electrical engineers soon came to demand such an installation in all high class systems. Since the old time tube, whose part was purely one of insulation, we have advanced to the tube the whole object of which is protection to the wire, insulation being placed where it is most serviceable, viz., on the wire itself.

The mechanically strong raceway for electrical conductors was a gradual but rapid growth, progress in this branch of the electrical field being forced by real necessity; it was found that protection to the wire from external mechanical injury was required, and along that line went development. The conduit first in use was composed of paper, which tube was later placed on the market encased in thin sheet brass. This was a step consistent with the purpose to which conduit was put. But brass proved ineffectual, and later a conduit was introduced which for a short time acknowledged no superior; this tube, called "Armorite," is yet being used in large quantities, a few engineers preferring a combination of insulating and protecting qualities in the raceway. In construction, "Armorite" conduit is peculiar, a description of which is as follows: The lining is made from live kiln dried basswood, cut with tongue and groove in two semi-cylindrical sections. These sections are then treated under pressure with a product of petroleum, which operation causes the liquid to penetrate the pores of the wood, thus destroying the active properties and excluding gases and moisture. The two sections of wood are then placed together (over a mandrel), forming a complete tube, and forced into a steel armor. The object in putting the wooden tube within the iron in two sections is that the conduit may easily bend to any angle without affecting the pipe or wood lining. During the early days of the manufacture of this conduit, the steel armor was a very light pipe; but the electrical trade required a stronger tube, consequently the light armored type was abandoned and a conduit manufactured embracing more rigidity and strength. This was accomplished by cutting the wood lining for a heavier gauge pipe and encasing same in a tube of the thickness and strength of the ordinary form of commercial gas pipe.

Finally, crowning the efforts in this line, was the introduction of "Loricated" conduit, a strong iron pipe, coated both on internal and external surfaces with a glass-like non-fused enamel. To this point has improvement in interior conduits advanced. And, judging by the satisfaction evidenced wherever this enameled tube has been installed, an improvement is not desired, if, indeed, improvement is possible. It is claimed that the highest class work and the most secure system of wiring is obtained by the use of enameled iron armored conduit, and that "Loricated" conduit is installed in all the monster buildings erected to-day, buildings on which are engineering marvels and which are as nearly perfect as the science of the times can devise. Limiting electrical energy to its proper channel is now a problem solved; the wire is carefully braided, the conductor then being drawn into a protecting raceway of enameled conduit, of the strength as above explained.

The protectory capacity of the conduit may for convenience in considering the subject be stated to be, firstly, in shielding the wire from mechanical injury, which might be caused by external agencies; secondly, in offering fireproof protection from the wire which may become heated; thirdly, in affording the installer with a smooth interior to the raceway into which the wires may readily be drawn without in any way tearing or otherwise injuring the braiding of the wire. In encasing the wire within an iron tube of the thickness and strength of commercial gas pipe, we have manifestly a sufficient protection to the wire from trowels, hatchets, nails and the like, to injury from which articles the unprotected wire would be subject at installation. The rigid pipe at no point on its surface offers an opening to a pointed tool, the smooth rounding surface turning the force of the blow from any instrument which might be directed towards the conduit. In this particular it is claimed to be in striking contrast with the flexible iron conduit, which at each unit of its length is said to present a crack or opening which will engage any point striking it, allowing danger to creep near the wire.

As to offering fireproof protection from any wire which may become heated, this point needs no enlargement; the fact is quite evident. It is apparent that most perfect results must necessarily be had in practice with the use of this superior type of enameled conduit.

One of the essential features of a perfectly safe electrical conduit is a smooth interior. This required smoothness, the manufacturers claim, is found most perfectly in a rigid enameled tube, as in tubes of other descriptions smooth and continuous surface is sometimes sacrificed in obtaining flexible, insulating and other unnecessary qualities. Slight observation will show to what extent a strip of steel or other metal wound in the form of a tube will cause an uneven interior surface; and to a slight extent the same fault is experienced in tubes which are lined with spirally wound paper, sheet rubber or other materials. A tube in the form of a gas pipe perfectly cleaned from burrs, scale and other imperfections (incident to pipe in the crude shape), the cleaned surface then being specially treated and prepared and finally enameled, as in the manufacture of "Loricated" electrical conduit, furnishes not only a safe installation for carrying electrical conductors, but also gives—what may not be of prime necessity, but is an item of importance in figuring cost—ease in construction and facility in drawing in the wire. In a tube of such description there is no buckling, no drawing away from the wall or straightening at the bends during installation, no splintering or loosening of a lining, no openings allowing entrance of moisture or particles of cement and like deteriorating agents to destroy the insullation of the wire, no projecting burrs or slivers of iron to tear the insullation, in short, no undesirable features; and after the wire is run safety is assured.

Messrs. Munderloh & Co., 61 St. Sulpice St., Montreal, Que., one of the leading electrical supply houses in Canada, advise us that electrical conduit has been a matter of serious consideration with them, and that they have found the trade call principally for the enameled type of conduit, the "Loricated" conduit, a product of the Safety-Armorite Conduit Company, Rankin Station, Penna., being generally used in high class installations. As a consequence, this is the only conduit they choose to handle. They have made such arrangements with the manufacturers that their stock is kept constantly replenished. They state that they hold the conduit trade of Canada (which is constantly growing to large proportions), and that they can lay electrical conduit down in any part of the country at most liberal terms.

ABOUT CONDENSERS.

IN arranging for jet condensation with engines of ordinary dimensions, it is necessary to use considerable caution, says the American Machinist, as by reason of the short time required to overflow there is danger of water backing up into the cylinder at stopping, or slowing down, and in such a case a breakdown is likely to occur on again starting ahead.

It is not always convenient to arrange the injection valve within such range of the throttle that it can be at once closed on slacking the speed, and even where it is so placed it is much more satisfactory to provide against flooding in a way that allows the valve to remain at normal opening, as the injection requires some attention to properly readjust after being once changed.

The best all-round method of accomplishing the desired result is to place a float in the condenser, an air cock being operated by the lever when water rises above a safety point. This arrangement relieves the engineer of all anxiety, his only responsibility being to see that the apparatus is maintained in proper repair and working condition.

If a float cannot be used, a simple air cock, worked from near the engine throttle, will be found the next best device, as by a turn of the hand wheel at slowing down air enters the condenser and holds the condensation water back without necessitating the closing of the injection valve.

The class of engine known as "high-pressure condensing," in which there is no vacuum under normal conditions—the exhaust steam being simply discharged into a tank of feed water for the purpose of heating the latter—should be supplied with a float and air cock, as on stopping the steam in cylinder on exhaust side of piston is liable to condense, and in that case, unless proper provision has been made to prevent it the feed water in tank will block up in the engine and possibly fracture the cylinder head when steam is again turned on.

The use of a float in either type of engine prevents flooding due to the pumps failing to function properly.

Air-pump valves are often found broken, if of metal, or torn, if of the soft rubber so often used, and in such cases the pump is likely to fail to clear the condenser.

Foreign substances, waste, chips, etc., are very often jammed in the passages, and where the valves open downward—hanging—held to their seats by springs, the stud nuts are liable to work loose, letting the valves fall into the chamber below. For this reason pumps should be designed with lifting valves only, in which type the springs can be much lighter, and the seating is far more satisfactory than where both the weight of valve and column of water must be balanced by the stiffness of a wire coil.

ENGINEERING and MECHANICS

EXAMINATION QUESTIONS.

W. H. WAKEMAN, in The Tradesman.

(Continued from April issue.)

49. How do you determine the capacity of a pump?

A.—Multiply the area of the piston by the stroke (both in inches) and by the number of strokes per minute. Multiply the area of piston-rod by the length of stroke, and by one-half the number of strokes per minute. Subtract this from the above, and the remainder will be the capacity of the pump in cubic inches, assuming it to be an ordinary steam pump. Divide by 231, and the result will be the number of United States gallons discharged by the pump, provided there is no "slip"; but the amount of water actually delivered will be less than the above calculation calls for, on account of the "slip," which varies with the kind of pump and its condition.

50. When piping up a pump, which valve would you put next to the boiler on the discharge pipe, and why?

A.— The stop-valve should always be put nearest the boiler, in order that the engineer may shut off the pressure when necessary to examine or repair the check-valve.

51. What is a British Thermal Unit?

A.—The amount of heat necessary to raise the temperature of one pound of water one degree Fah.

52. The stroke of an engine is 48 inches and the cut-off takes place at eight inches. What is the ratio of expansion?

A.—Six.

53. The initial pressure on a piston is 80 pounds, and the terminal pressure is 20 pounds, both absolute. What is the ratio of expansion?

A.—Four.

54. The initial pressure on the piston of an engine is 95 pounds and the terminal pressure 7 pounds, both by the gauge. What is the ratio of expansion and how is it calculated?

A.—This will depend upon the location, as the elevation above the sea will affect the result. In such cases it is customary to assume that the engine is at sea level, and to take the atmospheric pressure at 15 pounds per square inch, which must be added to both the pressures given, making them 110 and 22 respectively. Dividing the former by the latter shows that the ratio of expansion is five.

55. If the clearance is taken into account, how does it affect the result?

A.—It gives a lower rate, because the amount must be added to the stroke and also to the point of cut off. It is not taken into account when calculating the ratio by pressures.

56. Give five reasons for pounding in steam engines?

A.—Lost motion in the bearings, loose and worn piston rings, lack of compression, insufficient depth of counterbore, and a piston that is loose on the rod.

57. What is lap on a valve?

A.—The amount that it laps over its ports.

58. How many kinds of lap are there, and what are they?

A.—Two; inside and outside. The former means the amount towards the centre of valve, and the latter refers to the amount at the end of it.

59. What is meant by the lead of a valve?

A.—The amount that it is open when the engine is on a centre.

60. What is a port on a steam engine?

A.—A passage to admit steam to and exhaust it from a cylinder.

61. What are the larger on a Corliss engine, the steam or the exhaust ports?

A.—The exhaust ports are usually the larger, in order to allow the steam to escape without unnecessary back pressure.

62. Why are feed water heaters used?

A.—In order to save heat by heating the feed water with exhaust, or waste steam, and to prevent unequal contraction of boiler plates due to feeding cold water.

63. If you were obliged to feed cold water into a boiler, how would you have the feed pipe arranged?

A.—Such a practice should be condemned on every convenient occasion, but if it must be resorted to temporarily, the feed pipe should be continued into the body of water in the boiler, so as to avoid discharging it directly on to the plates.

64. Give four reasons for the failure of pumps to work?

A.—Failure of the water supply; leak in the suction pipe; valves that do not seat properly; and a piston that is worn so that the water slips by it.

65. Give two reasons for the failure of injectors to deliver water against pressure?

A.—If there is a leak in the suction pipe, air will enter and prevent the delivery of water, although it may not prevent the water from coming to the injector. If the water is so hot that it cannot condense the steam, the injector will not work against pressure.

66. Which is the heavier, a cubic foot of water at 40 degrees or a cubic foot of water at 210 degrees Fah.?

A.—The cubic foot of water at 40 degrees, because as heat is added raising the temperature above 40 degrees, the water expands and consequently becomes lighter.

67. A column of water is 60 feet high. How much pressure per square inch is on the base of it?

A.—The temperature will make some difference, but in all such examples it is customary to assume that it is about 60 degrees, in which case the pressure is found by multiplying the height by .434 and 60x.434 equals 26 pounds.

68. What is heat?

A.—Heat is a form of motion.

69. The fly wheel on an engine is 6 feet in diameter and revolves 210 times per minute. The main belt transmits power to a pulley on the jack shaft that is 4 feet in diameter. What is the speed of jack shaft.

A.—Three hundred and fifteen revolutions per minute. It is found by multiplying the speed of the fly wheel by its diameter and dividing by diameter of pulley on jack shaft.

70. The fly wheel on an engine is 18 feet in diameter and revolves 65 times per minute. What is the speed of the main belt?

A.—Three thousand six hundred and seventy-five feet. It is found by multiplying the diameter of wheel by 3.1416 and by the revolutions per minute. 18x3.1416x65 equals 3,675.

71. Does the cross head of an engine stop at each end of its stroke?

A.—Yes. It is impossible for the direction of motion to be changed so completely without first coming to a full stop.

72. How often would you blow down a boiler?

A.—That will depend on the quality of the feed water, the hours run per day and the rate of evaporation. In the case of a boiler worked to its full capacity, running from twelve to twenty-four hours per day and using a poor quality of water, it should be blown down once in four hours.

73. What is meant by the tensile strength of a boiler plate?

A.—It means the force required to tear asunder a bar of it that is one inch square.

WHEN A DYNAMO FAILS TO EXCITE.

IN the case of a self-exciting dynamo which refuses to build up, a number of tests have to be made in order to locate the "trouble," and it is often necessary to make these in a hurry, for which reason it is advisable to make them in the right order. A list of these tests is given in a recent issue of the London Electrical Engineer, and they are briefly as follows: Make sure that the brushes are on the right place on the commutator, and, of course, see that the brushes really touch. Then see that they are set properly, relatively to one another; that is, if there are several sets of brushes see that the distances apart are equal; should the armature have a double winding, the brushes must, of course, cover more than one commutator strip at a time and must, therefore, be of the proper thickness to do so. Then start the machine and run it at its proper speed; if this does not make it excite, then find whether the shunt winding is really connected with the brushes, and if it is, then try for ground leakage, which is especially important in the case of a shunt machine, for if the field is short circuited the dynamo will, of course, not excite at all. Then see if there is not a break in the field winding, a fault which is more likely to arise in shunt machines. In looking for possible ground connections it is, of course, desirable to disconnect the machine from the circuits, as one of the two faults may lie outside of the machine. If all this does not help, try changing the shunt connections at the brushes, for if they have been connected wrong it is evident that the machine cannot excite itself; also see to it that the field windings are so connected that they give the proper sequence of poles and are not both north or both south poles. If there are slight signs of a field it may help to connect the two halves of the shunt winding in parallel, if that is possible, as, for instance, if there are two coils to the magnet;

this would increase the current in the field; but this, of course, applies only to shunt and not to series wound machines, as in the latter the parallel connection would reduce the ampere turns. Also see to it that the shunt and series windings, if it is a compound machine, are not opposing each other, for in the latter case the machine might run with a few lights but would lose its field as the load is put on. If all this fails to locate the trouble, the armature must be examined; to find short circuited coils in the armature excite the machine separately from some other source and note which section becomes overheated. If this does not locate the trouble, then run the machine separately excited at the normal voltage and see if the armature has its normal output; if it has not and the machine is a new one, there is something wrong with the armature. If this also fails to locate the difficulty the case may be considered a fairly hopeless one, and an expert may be called in.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

ANNUAL BANQUET OF HAMILTON NO. 2.

The thirteenth annual banquet of Hamilton No. 2, C. A. S. E., was held at the Commercial Hotel, Hamilton, on Good Friday Eve, April 13th. Besides a large representation of local members, a number of visitors were present. The guests from Toronto included A. M. Wickens, Executive Secretary; Charles Moseley, ex-president Toronto No. 1; John Dixon, Toronto, No 18; John Bain, William Bourne, Joseph Hughes, and W. G. Blackgrove. The tables were tastefully decorated and an excellent menu was served. The chair was occupied by past president R. Mackie, while F. J. Sculthorpe acted as vice-chairman. The toasts were responded to as follows:

"Canada Our Home," Rev. J. H. Long; "Mayor and Corporation," Ald. Pettigrew, ex-Ald. Donald; "Manufacturers," Messrs. Lyman and Smith; "Educational Interests," J. S. Williams, C. R. Fessenden, W. Davidson, and R. W. Geddes, Boston, representative of the Scranton International School of Correspondence; "The Executive Head," Ald. Pettigrew, A. M. Wickens, Charles Moseley, John Dixon; "Sister Associations," John Dixon and a number of other visiting members from Toronto; "Our Host and Hostess," H. Maxey.

W. W. Barlow, Mr. Abbs, Dr. McLean and O. Penny contributed vocal selections, T. Arthur presiding at the piano.

The local committee who arranged for the banquet were: R. Mackie, chairman; T. Chubb, J. Ironside, W. R. Cornish, F. J. Sculthorpe, D. Hunter, T. Cook.

TRADE NOTES.

The Montreal Street Railway Company has placed an order with the Royal Electric Company for five 30 h. p. railway motors and controllers.

The Robb Engineering Co., Amherst, N.S., are building two 300 horse power tandem compound engines for the Demarara Electric Company, Georgetown, British Guiana.

The Waverly Gold Mines Co., of Waverly, N.S., has placed an order with the Royal Electric Co., of Montreal, for three of their direct current multipolar generators to light the Shubenacadie and Waverly mines.

The Robb Engineering Co., Amherst, N.S., recently received an order by cable from their English representatives, Messrs. Dick, Kerr & Co., for two 250 horse power engines for the Grimsby & Cleethorpes Electric Tramways.

Railway Motor Engineering is a new course of instruction offered by the International Correspondence Schools, Scranton, Pa. The course was prepared and is being kept up to date by Eugene C. Parham, superintendent of the Nassau Division of the Brooklin Rapid Transit. It is intended for operators and those who wish to become operators of electrical machinery, and contains practical instruction on the operation and maintenance of electric cars and motors. As instruction is carried on by mail, it affords a means of acquiring valuable information without obliging students to lose time from work.

The Canadian Association of Stationary Engineers, through Mr. Carscallen, M.P.P., brought forward at the recent session of the Ontario Legislature a bill providing for the inspection of boilers and the licensing of stationary engineers. A special committee was appointed to report on the bill. This committee, while approving to some extent of the principle of the bill, decided to take no action, but recommended that steps be taken next year to have a strict inspection of boilers in factories.

TELEGRAPH and TELEPHONE

CHEAPENING TELEPHONY.

THE greatest difficulties to be overcome in the engineering of telephone systems are in connection with the intricate network of wires required. From the house of every new subscriber two wires have to be taken to the exchange, and every new wire considerably increases the risk of breakdowns and short circuits. English statistics show that the time of an averge conversation is only two and a half minutes, and that the average number of calls is only eight per day. Assuming, then, that the subscriber is at his instrument twenty minutes a day making calls, and twenty minutes a day answering them, it follows that his wires are only used for forty minutes out of the fifteen hours which is the general duration of the daily service. The average load on telephone wires is, therefore, only about 5 per cent. of their full carrying capacity. Hence if we could make one pair of wires serve for several subscribers we could greatly cheapen the cost of the service. In the Electrician Mr. West recently described a system of telephony he has elaborated, whereby one pair of wires can be made to several subscribers. It has been thoroughly tested by the German postal authorities, and Mr. West states that they intend introducing it shortly into the German public telephone service. In this system the subscribers in one group can only ring up the exchange one at a time, the mere act of taking the telephone off the hook cutting out the others. If there are five ordinary subscribers the wires will be in use during a quarter of the time the exchange is open, and hence there will be a good deal of waiting; but to make up for this they will have the benefit of a 50 or 60 per cent. reduction of rates. Even with only three subscribers in a group a reduction of 30 per cent. could be given. The West system seems to us an excellent method of cheapening the cost of the telephone to groups of subscribers (preferably in the same building) who only use it very occasionally, as well as doing something towards reducing the multiplication of wires.

SHORT-CIRCUITS.

The Bell Telephone Company are this year extending their underground system in Winnipeg.

The Bell Telephone Company are about to commence work on the building of a long distance system in Manitoba. We understand that 7,000 poles, which will cover 200 miles of the line, are now ready. It is understood that direct connection will also be made with the United States.

Several important improvements have been made in the Bell Telephone Exchange at Ottawa. The bell-ringing system has given place to automatic signalling telephones, the interesting feature of which is that instead of ringing the bell as formally, the subscriber has only to put the phone to his ear. The act of removing it from the hook flashes a signal lamp at central and a prompt response is made. When the phone is replaced on the hook, another signal is given which notifies the central that the conversation is ended.

Mr. S. S. Dickinson, superintendent of the Commercial Cable Company at Canso, N.S., left early in April for the island of Fayal, in the Azores, via New York. His mission was to arrange for the reception of the company's German cable which will land there. When completed the cable will make a direct connection between New York and Germany. Six hundred miles of this cable had just been completed off the cost of Nova Scotia, and the object was to commence paying out the cable from the Island of Fayal until a connection was made with the portion completed off the Nova Scotia shore.

SPARKS.

The council of Sarnia, Ont., has passed a resolution requesting the Sarnia Street Railway Co. to adopt electricity as a motive power.

The council of Burlington, Ont., is considering the advisability of putting in a municipal electric light plant or giving a franchise to a company.

The Sarnia Gas & Electric light Co. have placed a contract with the Goldie McColloch Co., of Galt, for a 200 h. p. engine for their lighting plant.

Mr. Ernest S. Harrison, electrical contractor, of Winnipeg, is installing a new dynamo for the Keewatin Lumber Co., and is also re-arranging their lightning system.

Several prominent business men are promoting a scheme to establish a large power plant to supply the street railway, water works and private and public lighting in Woodstock, Ont.

The town council of St. Mary's, Ont., has been discussing the question of taking over the electric lighting plant of Mr. L. H. Reesor, and of submitting a by-law to the ratepayers for the purpose.

The village council of Canington, Ont., decided at a recent meeting to engage an electrical engineer to value the electric light plant, which will probably be taken over by the corporation.

Surveys have been made to locate an electric railway from Greenwood into the gold mines of the Deadwood, Wellington and Summit camps, the power to be supplied from Cascade. The promoters are the Greenwood and Pheonix Tramway Co., and the cost is estimated at $100,000.

The dam across the Murray river, built by the Labrador Electric and Pulp Company, is about completed. By the end of June it is expected that the villages of Murray Bay and Pointe au Pic, Quebec, will be lighted by electricity.

The Railway Committee of the Ontario Legislature has thrown out the bill of the Port Stanley Electric Railway Co., by which power was sought to increase the capital of the company from $40,000 to $240,000 and to build a line to London.

The Hinton Electric Company have submitted to the city council of Victoria, B.C., a proposition to operate the city pumping station by electricity. The cost was given as $22,900, made up as follows: Engine and dynamo, $9,800; 100,000 gallon electrically driven pump, $7,600; necessary wire, line material, etc., $5,500.

MOONLIGHT SCHEDULE FOR MAY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 7.30	A.M. 4.00	83.0
2....	" 7.30	" 4.00	83.0
3....	" 10.30	" 4.00	53.0
4....	" 11.00	" 4.00	50.0
5....	" 11.30	" 3.50	42.0
7....	A.M. 0.10	" 3.50	34.0
8....	" 0.30	" 3.50	32.0
9....	" 1.00	" 3.50	25.0
10....	" 1.20	" 3.50	23.0
11....	" 1.50	" 3.50	20.0
12....	No Light.	No Light.	.....
13....	No Light.	No Light.	.....
14....	No Light.	No Light.	.....
15....	No Light.	No Light.	.....
16....	P.M. 7.40	P.M. 10.20	2.40
17 ...	" 7.40	" 11.10	3.30
18....	" 7.40	A.M. 0.00	4.20
19....	" 7.40	" 0.30	4.50
20....	" 7.50	" 1.10	5.20
21.. .	" 7.50	" 1.40	5.50
22....	" 7.50	" 2.10	6.20
23....	" 7.50	" 2.50	7.00
24....	" 7.50	" 3.30	7.40
25 ...	" 7.50	" 3.30	7.40
26....	" 7.50	" 3.30	7.40
27....	" 8.00	" 3.30	7.30
28....	" 8.00	" 3.30	7.30
29.	" 8.00	" 3.30	7.30
30. .	" 8.00	" 3.30	7.30
31	" 9.00	" 3.30	7.30
		Total......	145.30

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TYPE "C" INDUCTION MOTORS

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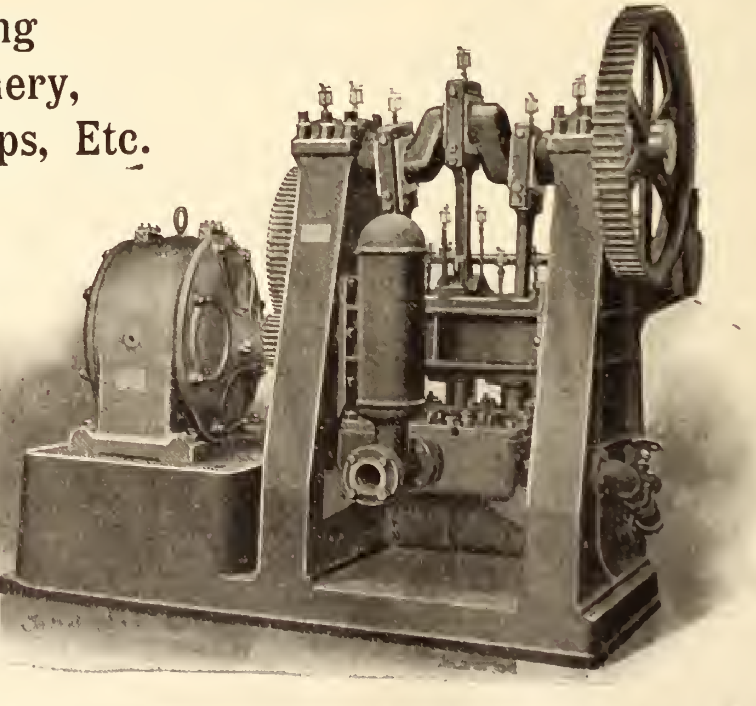
For Economy



AHEARN & SOPER - OTTAWA
AGENTS FOR CANADA

THE FORTHCOMING CONVENTION.

THE fire which occurred in Ottawa recently will not, we understand, seriously affect the forthcoming convention of the Canadian Electrical Association, although it will increase the labors of the members of the local committee. This committee is working faithfully to make the convention an unprecedented success. The committee on papers has also been performing its duties energetically, and some excellent papers have been secured. Among them is one by Professor Owens, of McGill University, on "Utilizing the Available Central Station Capacity"; another by Mr. F. H. Leonard, of Montreal, on "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps," and another by Mr. O. Higman, of Ottawa, on "Government Electric Standards." Papers are also expected bearing upon telephony and telegraphy, the operation of street railways, and other interesting subjects. The date of the convention is June 27th, 28th and 29th.

THE OTTAWA FIRE.

THE electrical companies in Ottawa suffered heavy loss by the recent fire which commenced in Hull, and which destroyed the major portion of the city of Hull and nearly two thousand buildings in Ottawa. The fire totally destroyed the street railway power house and contents, but the new 1200 k. w. generator direct connected to six Stillwell-Bierce horizontal turbines, which was installed recently in a new power house, was saved owing to its being built largely underground. The Ottawa Electric Co. (the lighting company) being the result of the amalgamation of three former electric lighting companies, had six power houses, namely, one central distributing station and five sub-stations, one of which was a steam station, and another was devoted to arc light exclusively. Four of these sub-stations, including the arc light station, were totally destroyed, even the walls of the buildings being useless. The company was left with its central station and steam auxiliary. While the arc light station was burning negotiations were going on for machinery for temporary use. We understand that letters of sympathy were received from the principal electric lighting companies in Canada, and valuable services were rendered by the Royal Electric Light Co., of Montreal, and the Toronto Electric Light Co. The company is now engaged in setting up, in a building owned by Mr. J. R. Booth where some water wheels were available, a temporary sub-station which will enable it to carry on its ordinary service while a new plant is being installed. The company is now supplying nearly all its incandescent service and motor service. Three days after the fire 150 street lamps were going, and it is expected that by the 10th inst. all the street lights will be on.

The Street Railway Company did not stop running, although the service was limited to some extent for a few days. They are now running full blast.

It is the intention of the Ottawa Electric Co. to erect a new and strictly up to date plant.

REMOVAL NOTICE.

After May 1st the Montreal office of this publication was removed to larger quarters in the Imperial Building, 107 St. James street. Customers will always find the office open during business hours, and visitors in Montreal are extended a cordial invitation to call at the office, where they will be given every possible assistance and furnished with requisites for answering correspondence. The telephone number is Main 2299.

PERSONAL.

Mr. Melitz has been engaged as electrician by the corporation of Acton, Ont.

Mr. John E. Wilson has commenced his duties as inspector of gas and electric light at St. John, N.B.

The management of the Winnipeg Street Railway have appointed Mr. Albert Mitchell as superintendent of the system, in succession to Mr. H. J. Somerset, who has removed to Australia.

Mr. W. Y. Hayes, manager of Bell Telephone Company at Windsor, Ont., is receiving the congratulations of his friends upon his recent marriage. The bride was Miss Harris, of London.

Mr. C. H. Wright, son of Mr. A. A. Wright, of Renfrew, has joined the engineering staff of the Canadian General Electric Company. Mr. Wright has been employed for the last four years on the Montreal Belt Line Railway, and when leaving he was dined by his fellow employees and presented with a diamond scarf pin.

The Sydney Gas & Electric Co., Sydney, C.B., is installing a 150 k.w. "S.K.C." two-phase generator, purchased from the Royal Electric Co., of Montreal.

Mr. John Carew, Lindsay, Ont., has ordered from the Royal Electric Company a complete electric light plant to light his saw mill and lumber yards. The order included a 10 k.w. multipolar generator.

ENGINEERS, Firemen, Machinists, and electricians : Send 10 cents for new 44 page pamphlet, containing list of questions asked by Examining Board of Engineers. GEORGE A. ZELLER, Bookseller, St. Louis, Mo., U.S.A. Mention CANADIAN ELECTRICAL NEWS.

WANTED

A Practical Electrician and Engineer, with nine years' experience with electric light and power plants, familiar with inside and outside wiring for all systems, also with office work, desires a position with an electric light company as manager or electrician. Can furnish references. The right man to build up a plant. Address, B. W. E., care CANADIAN ELECTRICAL NEWS, Toronto, Ont.

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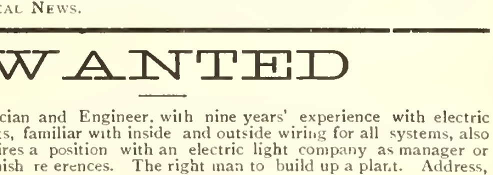
That there are more Victor Turbines in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.



FEATURES WORTH REMEMBERING

High Speed, Close Regulation, Great Capacity
High Efficiency, Perfect Cylinder Gate, Steady Motion

RECENT PLANTS INSTALLED:—Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Cataract Power Co., Hamilton, Ont.

CORRESPONDENCE SOLICITED.

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PUBLICATIONS.

"Compound Engines" is the title of a booklet of fifty pages just issued by the Power Publishing Company, of New York. It consists of a series of lectures by R. F. Lowe, re-printed from the columns of Power.

The Fort Wayne Electric Corporation have issued a booklet showing the prices paid for electric lighting throughout the United States. The arrangement is tabular form, the population, number of lamps, candle power, schedule, price per lamp, and cost of fuel, whether steam or water power, being given.

The Gas Engine Publishing Company, of Cincinnati, Ohio, have sent us a copy of the Gas Engine Hand-Book, by E. W. Roberts, editor of The Gas Engine. From a perusal of the book we can safely say that it is a valuable work, containing no descriptive matter relating to any particular engines unless the engine is a type in itself, as is the case with the Diesel motor. The author has covered in the 220 pages almost the entire subject of the gas engine design, and many of the formulas given are claimed to have not previously appeared in any work. Fifty thousand copies of the first edition were issued.

SPARKS.

The fire and water committee of the Berlin city council has been empowered to advertise for tenders for street lighting.

Local capitalists at Selkirk, Man., have applied for a charter to construct an electric railway and telegraph line from Winnipeg to that place.

The Baltimore Railway and Coal Company is considering the question of developing the oil wells in the vicinity of Baltimore, Albert County, N. B.

The electric light plant at Cardinal, Ont., was almost completely destroyed by fire on April 18th. The fire broke out in the Edwardsburg starch works.

The Montreal Star have placed an order with the Royal Electric Company for three 30 h. p. motor Teaser equipments, to be direct connected to their new printing presses.

The town of Yarmouth, N.S., has just taken tenders on two compound condensing steam engines of 60 h.p., with two boilers and fittings, for operating the plant at the pumping station.

It is said that the business of the Still Motor Company in Toronto has been purchased by British capitalists.

The Royal Electric Company, of Montreal, is installing an electric light plant for the Moulthrop Lumber Company in their mills at Spanish River, Ontario.

The Nova Scotia Electric Light Co. has made a second survey of the source from which it is intended to derive electric power for the Annapolis Valley. The company is said to be making plans to commence work at once.

The Marine Telephone Company, Limited, of Letete, N.B., is seeking incorporation, to establish a telephone system between St. George, Letete, Fairhaven, and other places. J. F. Catherine and Judson Matthews, of Letete, are interested.

Mr. W. B. Chapman, who is interested in the Demarara Electric Co., Georgetown, British Guiana, has returned to Montreal after an absence of five months. Mr. Chapman states that the work upon the electric plant is progressing favorably.

At the last meeting of the council of St. Louis du Mile End, a suburb of Montreal, the Royal Electric Company was given the contract for street lighting for the next five years. Forty-two lamps will be used, and the price, we understand, is $115 per lamp.

The forty-first meeting of the American Society of Mechanical Engineers will be held in Cincinnati, Ohio, commencing on May 15th. Papers will be read on the following subjects: On the Value of a Horse Power; Hot Water Heating from a Central Station; Systems of Efficiency of Electrical Transmission in Factories and Mills; Multiple Cylinder Engines; The Automobile Waggon for Heavy Duty.

Last month the Ontario Power Co. signed a contract of agreement with the commissioners of the Queen Victoria Niagara Falls Park, and paid over the some of $300,000 representing the renta for two years. The company received its franchise to develop power from the Niagara river. The Ontario Power Co. will compete with the power company at Niagara Falls, N.Y. It is said to be the intention to commence development work immediately, the inital development to be from 30,000 to 60,000 h. p. The prospect of transmitting it to Toronto and Hamilton is reported to have been considered. The estimated cost of the proposed work is $2,000,000.

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SIEMENS & HALSKE ELECTRIC CO. OF AMERICA

To Officers and Managers of Central Stations:

The Duncan Integrating Wattmeters manufactured by the Siemens & Halske Electric Company of America are constructed after my design and under my personal supervision.

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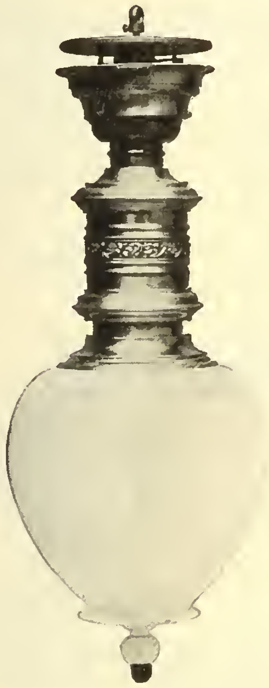
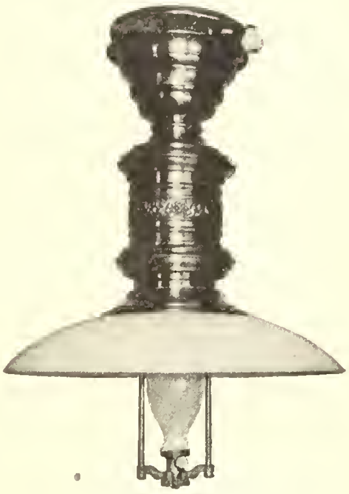


STYLE NO. 200.
D. B. Trim. Brass.

You are invited to investigate our A. C. Series Enclosed Arc System.

MANHATTAN REGULATING REACTANCE COIL

to provide for any percentage of circuit.



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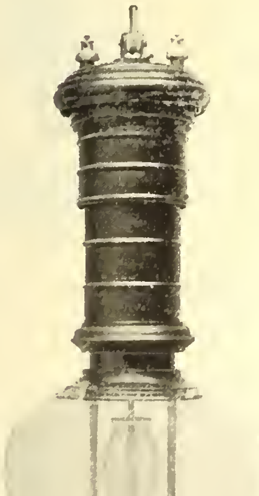
Reflector. Brass.



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D. B. Trim. Iron.

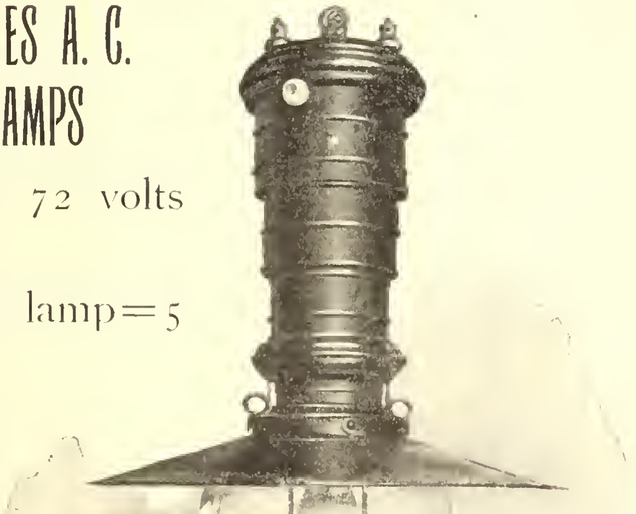
MANHATTAN SERIES A. C. ENCLOSED ARC LAMPS

At 6.6 amp. 72 volts arc=430 watts.

Total loss in lamp=5 watts.

Efficiency =99%.

Power factor complete circuit of Lamps and Regulator=.89.



STYLE NO. 1083.
C. G. Trim. Iron.

Manhattan General Construction Co.

Head Office: NEWARK, N.J. Canadian Office: Temple Bldg., TORONTO, CAN.

SPARKS.

The Ottawa Railway Co. intend building new car sheds.

The Calgary Water Power Co., of Calgary, N.W.T., has just installed a new two-phase generator.

The county council of Colchester, N. S., will purchase a new boiler for heating the registry office and jail at Truro.

The electric plant at St. Hyacinthe, Que., was inundated by water last month, and for a time the town was in darkness.

The electric light plant at Digby, N. S., is still owned by Major Daley, who purposes thoroughly overhauling the system.

A committee of the council of Bedford, Que., is obtaining information as to the cost of electric lighting, and it is probable that a civic plant will be installed there.

The Keewatin Power Co. are understood to have closed a deal with the owners of the Sultana mine to transmit power from Norman to the mines, to operate the machinery.

Incorporation has been granted to the Plessisville Electric Co., of Plessisville, Que., to supply light, heat and power throughout the counties of Megantic and Arthabaska. Mr. Francis Hurtubise is manager of the company.

The council of Merritton, Ontario, recently employed the services of Mr. W. T. Steward, E.E., of Toronto, to value the electric light plant of that place, as the corporation purposes purchasing the same in the near future.

Incorporation has been granted to the Suderland Electric Power Co., of Suderland, Ont., with a capital of $10,000. The provisional directors are: James McDermott, J. B. Valentine, Hendry Baldwin, James Doble and T. H. Glendining.

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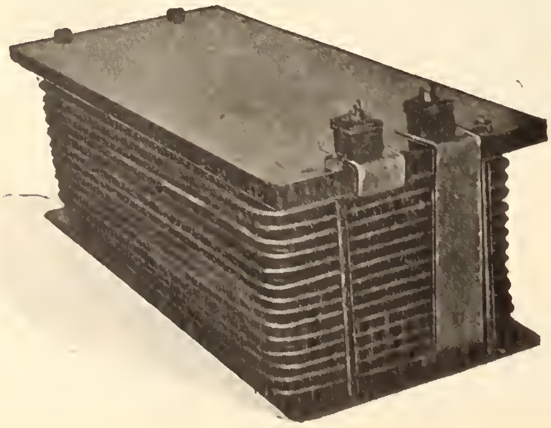

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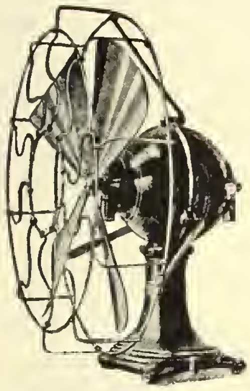

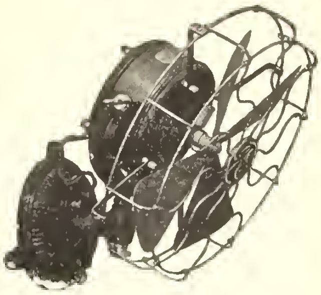

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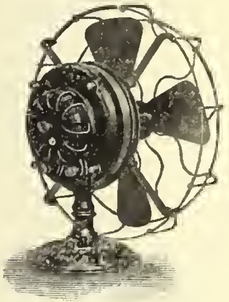

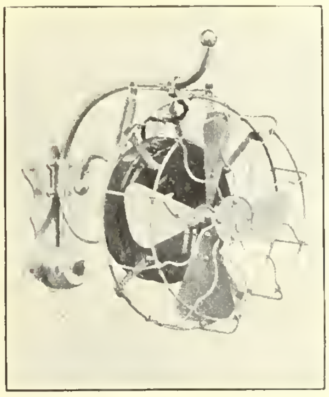

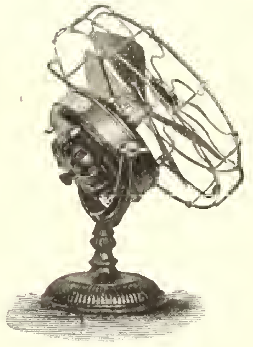

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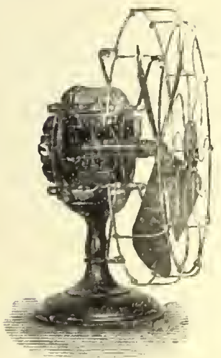

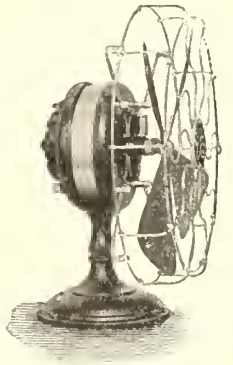

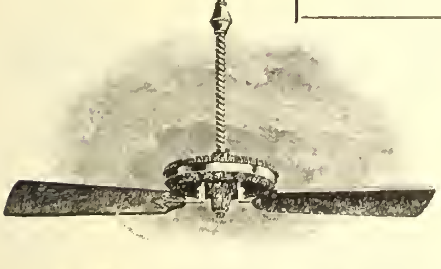

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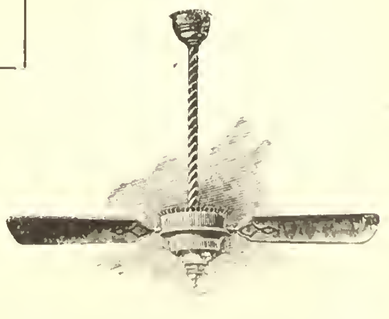

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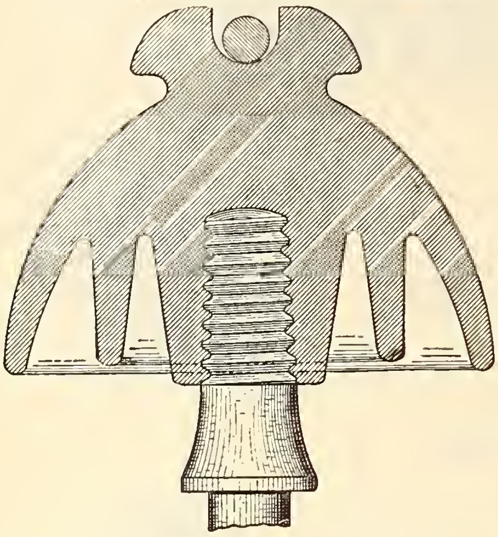

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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N. Y. Evening Post, Oct. 9. 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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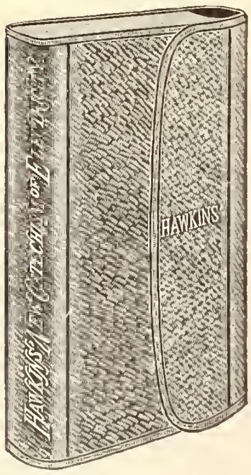

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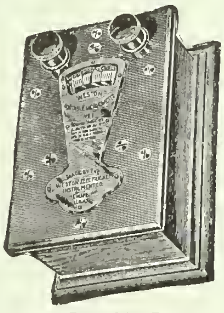

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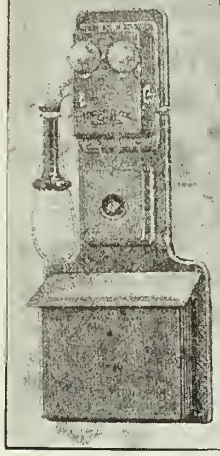

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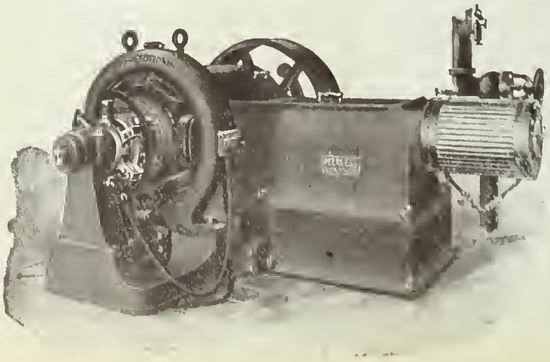

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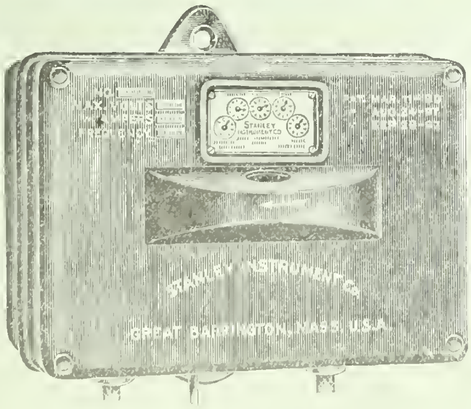

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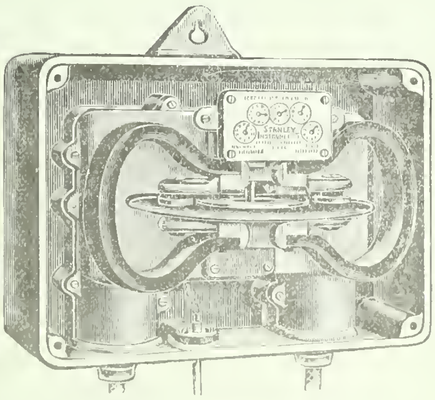

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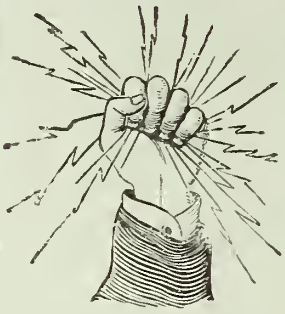
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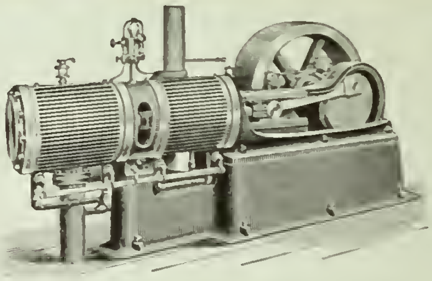
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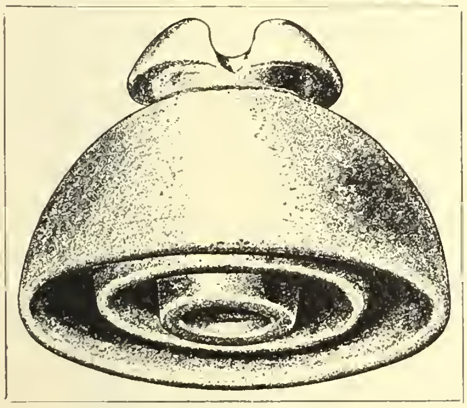

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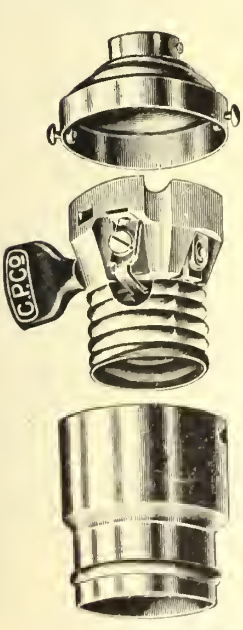

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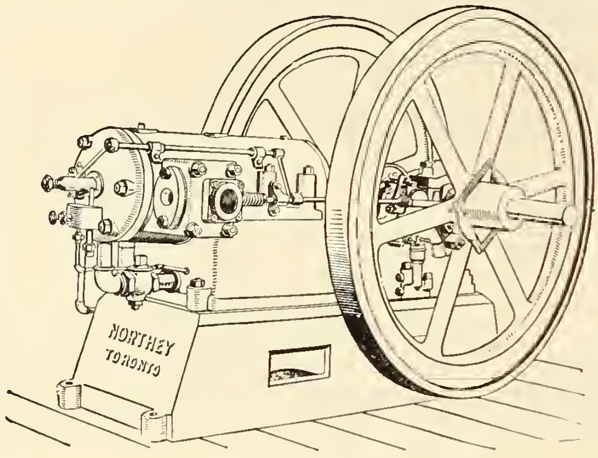

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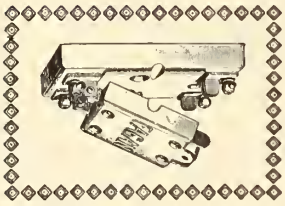

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PUMPS
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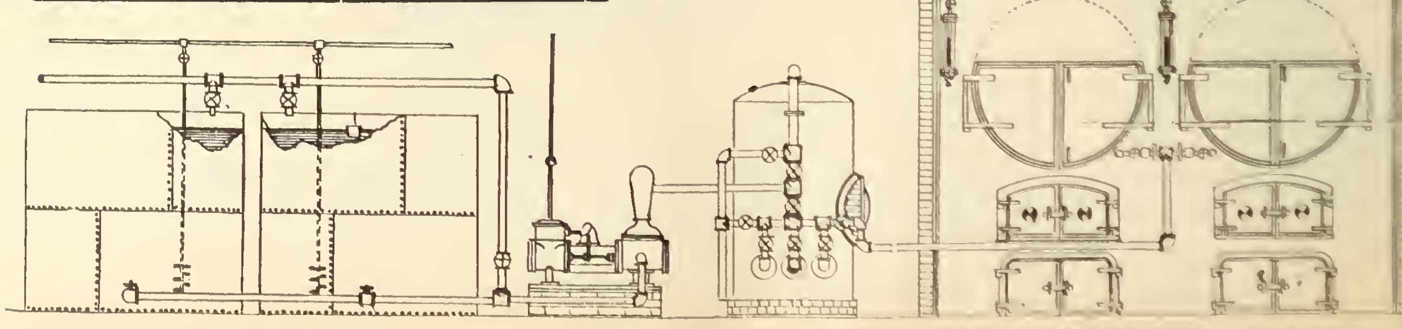

JOHN McDOUGALL - Caledonian Iron Works, MONTREAL, QUE.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

Vol. X. JUNE, 1900 No. 5.

THE LINDSAY LIGHT, HEAT AND POWER COMPANY.

Opening of Their Electrical Transmission Plant.

A representative of the ELECTRICAL NEWS journeyed to Lindsay on Thursday, May 31st, to witness the formal opening of the new power plant of the Lindsay, Light, Heat and Power Company. Almost every Canadian was enjoying a holiday, in recognition of the news of the surrender of Pretoria, and at two o'clock in the afternoon upwards of one hundred and fifty persons got on board the steamer Crandèlla, provided by the company, which carried them from Lindsay to Fenelon Falls, where the power plant is located. The sail up the picturesque Scugog river was most enjoyable. Music was furnished by an orchestra.

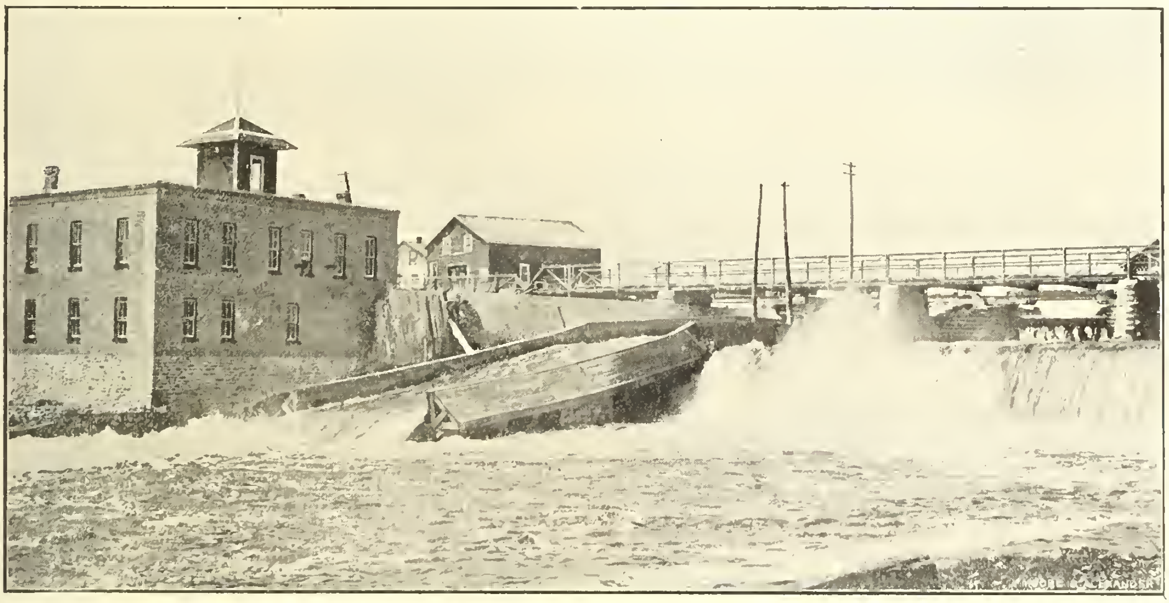

FIG. 1.—GENERAL VIEW OF FALLS AND POWER HOUSE.

At Fenelon Falls about an hour was spent in inspecting the falls and power house. In the absence of the president, Mr. Wm. Needler, the machinery was set in motion by the vice-president, Mr. Thos. Sadler, and its operation explained by Mr. C. H. Mitchell, engineer in charge of the hydraulic work. On the return trip the party reached Lindsay about 8 p. m.

ORIGIN OF THE COMPANY.

Some years ago Mr. B. F. Reesor, then one of the members of the Newmarket Electric Light Company, recognizing that electricity was but in its infancy, decided to install an electric light plant in the town of Lindsay. This being accomplished, he was given the contract for street lighting. His success induced competition, and another company was formed and continued to exist for some years. Mr. Reesor was joined by Messrs. Wm. Needler and Thos. Sadler, two prominent business men of the town, and the outcome of this amalgamation of capital was the incorporation of the Light, Heat and Power Company, of Lindsay, Limited, with a capital of $125,000, and the purchase of the competing electric and gas plants. Mr. Wm. Needler is president of the company, Mr. Thos. Sadler vice-president, and Mr. B. F. Reesor managing-director and secretary. For some time the company had been giving some consideration to the question of transmitting power from Fenelon Falls, and a demand for increased power, together, perhaps, with rumors of competition from a new company, resulted in the decision of the directors to undertake the development of the water power at that place.

Early in the spring of 1899, the company purchased the water power from the Smith estate, or, more correctly speaking, secured a franchise to utilize 1,100 horse power. As the townships of Ops and Fenelon had granted a pole-line franchise to another party, the Lindsay, Light, Heat and Power Company applied to and secured from the Grand Trunk Railway permission to use their right of way between Lindsay and Fenelon Falls. The work of development was commenced in July of last year.

HYDRAULIC DEVELOPMENT.

The hydraulic division of the power plant is quite simple and compact. The falls at Fenelon, situated on the Gull river, are about fifteen feet in height, and a short distance above the Government maintains a wooden dam for the purposes of the Trent Valley canal system, two locks of which are at this point, thus forming a beautiful sheet of water called Balsam Lake. This dam and the falls provide a total nominal head of 24 feet. The water is drawn off the upper level through a head race on the west side of the dam, and is led to the power house, which is situated immediately below the falls. The head race is substantially built in rock, the river side being formed by a heavy concrete retaining wall, the short side cut in rock, and the whole being about 150 feet in length. The head gates consist of a set of heavy stop logs with convenient raising devices, and the minimum section of race is 10 by 26 feet. Racks and seats for lower stop logs are provided at the piers and head wall in the north side of the power house, the steel flumes leading directly from the race at this point.

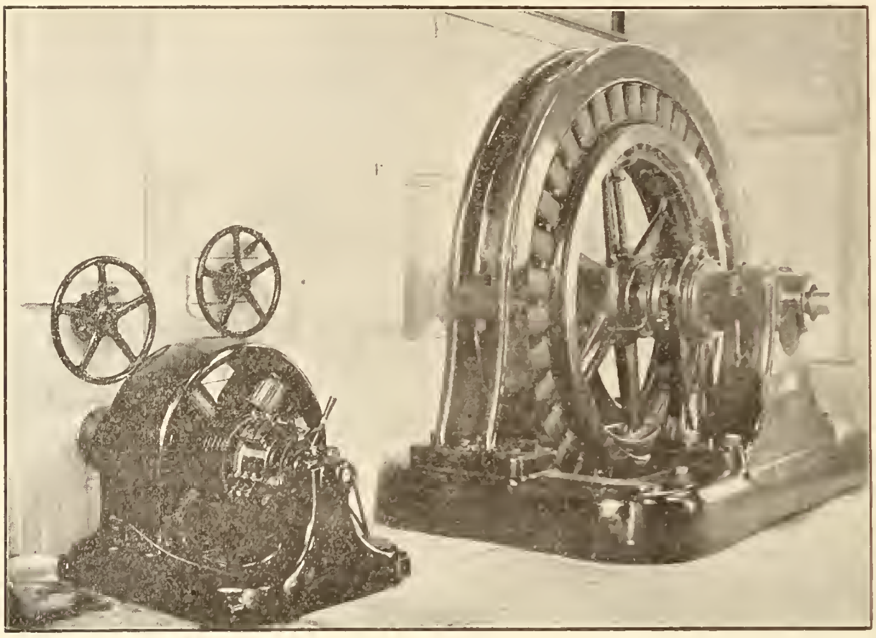

FIG. 2.—GENERATOR AND EXCITER.

THE POWER HOUSE.

The power house occupies the site of the old Smith saw mill, in fact, it was built up inside of the mill, the latter being torn down afterwards. The building is 37 x 52 feet inside, and all available space is occupied, as the location is cramped owing to the rocky bank of the river. A splendid view of the power house and falls is shown on the previous page. The power house is of plain but substantial construction, built of brick with stone foundation, and consists of two floors, the lower one containing the hydraulic machinery and generators, the upper having the lighter equipment, such as high potential switchboard, transformers, blower, stores, offices, etc., access to which is had directly from the bank level above the falls.

The head wall of the forebay, with its piers, forms the upper foundation wall of the building, and through this the three flumes lead the water to the wheels. Two of these are 11 feet in diameter and the third is 4 feet in diameter. The large flume next the river and the small one are already in use, the other large flume not being yet completed, but it will be used when future extension is made.

The hydraulic plant already in operation consists of a pair of 40-inch Samson turbines, of the Leffel type, for the generator, and a 20-inch turbine of the same make for the exciter. The turbines were mauufactured by the William Hamilton Manufacturing Company, of Peterboro, Ont. The pair of power turbines are connected with the generator by a 7-inch horizontal shaft, and will generate together upwards of 650 horse power under a head of 24 feet, using about 300 cubic feet of water per second, and running at 200 r. p. m. The small wheel to run the exciter will develop about 60 h. p., only about half of which will be used by the exciter. The company are, therefore, using less than one-half of the water to which they are entitled by their franchise. At present the water wheel governor is not installed, but it is the intention to put in a high-class governor at an early date. The discharge of the water from the wheels is into a tail race cut into the rock below the falls, by which it enters the swift waters of the river, thus flowing rapidly away, a feature which is very important. Another promising feature of this plant is the absence of the formation of anchor ice, as the conditions for such cannot arise in the head race or in Balsam Lake above.

The intention of the company is to duplicate the present power plant as soon as the demand for power makes it advisable to do so. There is ample provision made for this in the power house and general works, and the water privileges of the company and consequent power obtainable are quite sufficient for a total output of some 1,000 h. p.

ELECTRICAL EQUIPMENT.

The generator building, as it stands at present, contains but one of the two direct connected generators which it is proposed shall form the ultimate equipment of the plant. This machine is a 400 kilowatt, 550 volt, three-phase revolving armature generator of the Canadian General Electric Company's standard design, driven at 200 revolutions per minute by the wheels described above, to the shaft of which it is directly coupled without any insulating device. The field frame is cast

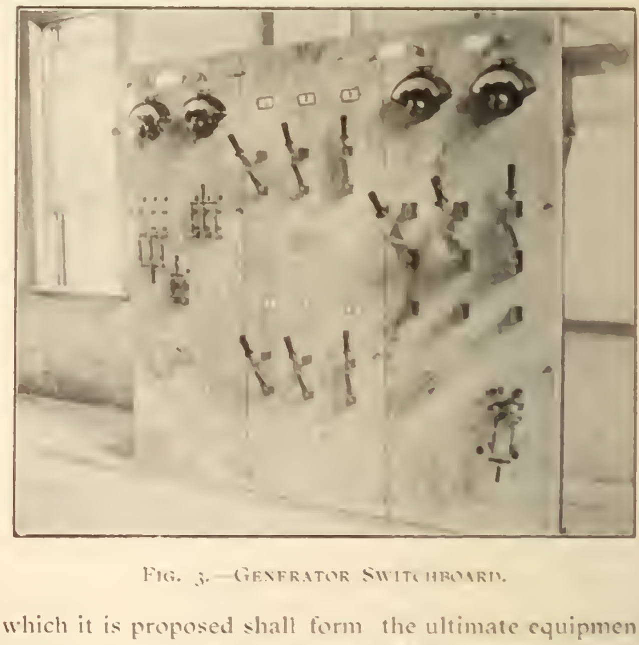

FIG. 3.—GENERATOR SWITCHBOARD.

round laminated internally projecting fields, 36 in number, thus giving a frequency of 60 p. p. s.

The exciter consists of one 20 k. w., 125 volt, form "H" generator, running at 385 revolutions per minute, being directly connected to its wheel shaft similarly to the alternator. This method of connecting the exciter to a separate wheel is a comparatively new feature in engineering practice, possessing many valuable features over the usual method of belting from the generator shaft, and one the success of which will be watched with some interest. The exciter has capacity for exciting four machines similar to the one now in use, so that when the present equipment is doubled there will still be a large reserve of exciting power. A view of the generator and exciter is shown in Fig. 2.

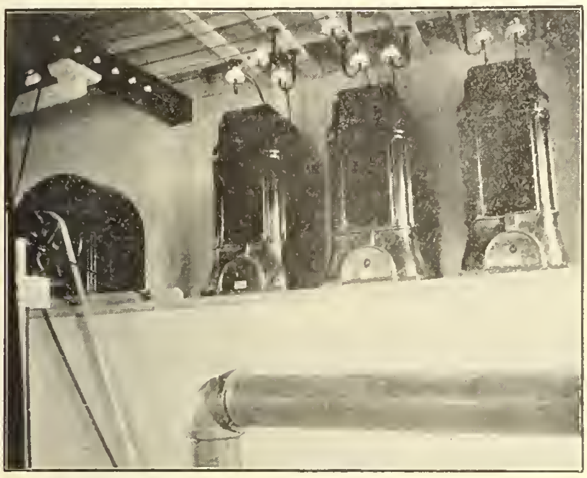

FIG. 4.—STEP-UP TRANSFORMERS IN POWER HOUSE.

The low tension switch-board, as shown in Fig. 3, is placed directly in front of the generators, so that the attendant has everything in plain view and within easy reach without having to move from the board. The board is of polished blue Vermont marble. Each panel, of which there are three at present installed, is in one piece, 80 inches high and 30 inches wide, this size enabling a very pleasing and symmetrical distribution of the apparatus contained. There is mounted on the boards the usual equipment of instruments and switches, the former of the Inclined Coil type, finished in black oxide, the latter being single-pole and quick-break for the heavier currents and of the ordinary double pole type for the smaller circuits. The three panels as installed control the generator, the exciter and the low tension side of the step-up transformers. When the capacity of the plant is increased three more panels will be added, one each with the additional machine and exciter, and one for the synchronizing instruments and paralleling switches which will then be necessary. The low tension transformer switches are arranged so that any one of the three transformers can be instantly cut out of service without in the least affecting the operation of the system ; thus even should they be supplying a 24-hour service they can be regularly inspected and cleaned without danger to the attendant. Provision is also made on the board so that when the plant is increased either machine can be run separately on either set of transformers or all can be run in parallel.

All the low tension wiring is carried under-ground in conduits placed in the cement floor and covered by iron checker plate, this keeping all leads out of the way and free from liability to damage, at the same time giving facilities for inspection not excelled by overhead open work.

The three step-up transformers (Fig. 4) are rated at 135 k. w. each and give a pressure of 11,600 volts to the line. They are of the Canadian General Electric Company's standard air blast type, the primary and secondary windings being so arranged with ventilating blocks between that a very large radiating service is presented to the air blast provided by the blower, and thus the weight and floor space are both kept within very moderate limits; they run very cool under even heavy overloads, and the efficiency is high.

The blower is of the Buffalo Forge Co.'s standard low pressure type, 50 inches in diameter, and, like the exciter, is capable of delivering about four times its present output. It is driven by a two horse-power 500 volt induction motor, placed on the floor level. The blower stands on top of the air chamber similarly to the transformers, the discharge being down into the air chamber, which is of ample dimensions to allow the transformers being inspected and cleaned without difficulty.

The high tension panels, two in number, are placed close to the transformers, in order to keep down the amount of high tension wiring necessary. One contains six s. p. snap break switches, separated by marble barriers and controlling the transformer primaries, being connected so that any transformer can be cut off the line instantly if necessary. The other panel contains ground detectors of the astatic type, which are permanently connected to the line, and thus give a continuous indication of the state of its insulation. The high potential board is shown in Fig. 5.

The lines from the high tension panel ascend vertically to a wire cupola placed in the centre of the roof, going through its walls in heavy porcelain tubes to a cross arm bolted to the wall, and from there directly to the first pole. The eaves of the cupola are extended so as to thoroughly protect the lines from any wet or dirt and the point where they pass through its walls. This cupola also contains the lightning arresters, of the Wirt type, one for each line, each consisting of a number of 2,000 volt arresters connected in series.

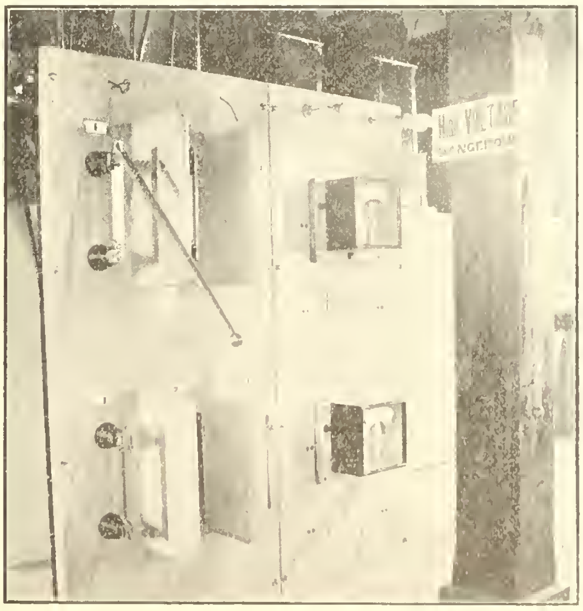

FIG. 5.—HIGH POTENTIAL SWITCHBOARD IN POWER HOUSE.

THE POLE LINE.

The transmission line, fourteen miles in length, runs from the power house for about three-quarters of a mile over private right of way until it strikes the Grand Trunk track running from Haliburton to Lindsay, which it then follows to within half a mile of the Lindsay town limits, there leaving the track and running directly south on Main street to the sub-station. It consists of three No. 4 B. & S. copper wires, bare, except for the small part inside the corporation limits, which latter is weatherproof. The wire was supplied by the Dominion Wire Company, of Montreal. The line is supported throughout by No. 1 Imperial porcelain insulators, triple-petticoated and tested to 20,000 volts. The pins are locust, the cross-arms being of 4x5 tamarack and double braced. The three wires are at present supported on one arm, though when the second line is strung they will be arranged so as to provide against any chance of voltage disturbance from mutual inductance of the two circuits ; it was not considered necessary to transpose the three wires now in use.

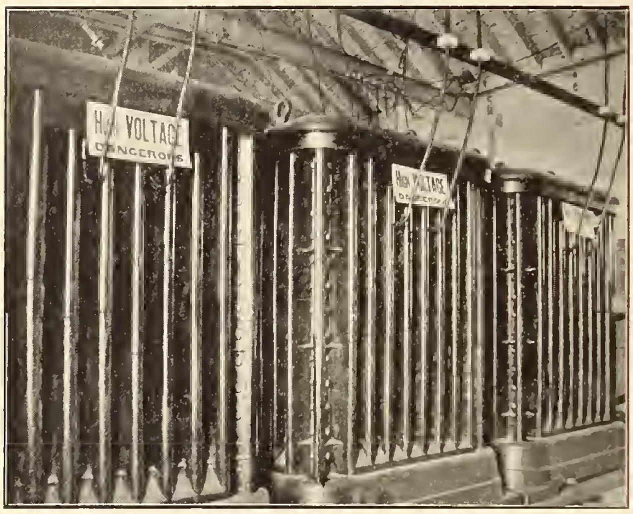

Fig. 6.—Step-Down Transformers in Sub-Station.

Below the transmission line is a telephone line, run on a standard two-pin arm, with the usual glass insulators placed three feet below the main line and transposed every fifth pole. The wire is No. 12 I.W.G. galvanized iron. No difficulty whatever has been experienced from induction troubles, the service being perfect, independent of the load on the main line.

The poles are of cedar, set 56 to the mile, varying from 35 to 50 feet in height, so as to make the line as level as possible. For the greater part of the distance no difficulty was experienced in setting them, as the ground is clean, though a little blasting was necessary on account of rock found near the Falls, and when crossing swamp the poles are for some 4000 feet supported by piles, to which they are bolted, some special device of this character being rendered necessary by the water which at this point covers the ground for the greater part of the year.

In addition to the lightning protection provided in both stations, a barb wire line runs over the full length of the transmission, fastened securely to the top of each pole and grounded at every third. This, it is expected, will take the majority of the discharges occurring near the line.

THE SUB-STATION.

The Lindsay Light, Heat and Power Company, before the installation of the new plant, ran two steam driven stations, and one of these has been changed to accommodate the new apparatus and is used as a sub-station. It contains a high tension panel similar to that of the power house controlling the primaries of the three oil-cooled 135 k. w. step-down transformers, giving a secondary voltage, which is varied, according to the load, from 1,050 to 1,150 volts, at which pressure the current is distributed to the lights and motors throughout the town.

Like the power house, all the sub-station low tension wiring is run in conduits under the floor, which is cement. The low tension switchboard consists of four polished marble panels, one similar to that in the power house, controlling the 1,040 volt side of the transformers, one containing the ammeters, voltmeters and ground detectors, and the remaining two containing switches controlling the various circuits throughout the town, these being arranged so that three phase or single phase distribution can be made as desired.

Power is now being supplied for lighting and power purposes in the town of Lindsay, and it is said that the current is steadier and more satisfactory than when the steam plant was in use. The company at present have the contract for lighting the streets of the town. They are also supplying a number of commercial lights and a quantity of power for grain elevators, refrigerating machines, printing presses, and other service. Their present lighting business consists of 7,000 incandescent lights of 16 c. p. and 60 arc lights of 60 c. p. It is said that in proportion to its population, the town of Lindsay uses more electric current than any other town in Canada.

All the electrical apparatus was furnished and installed by the Canadian General Electric Company, the expert work being done by Mr. Davies, of Toronto, and Mr. Smallpiece, of Peterborough. Mr. C. H. Mitchell, C.E., of Niagara Falls, Ont., had entire charge of the power development, which reflects great credit upon him. The power house and pole line construction was carried out by the Lindsay, Light, Heat and Power Company, under the superintendence of Mr. B. F. Reesor, assisted by his son, Mr. Walter Reesor. The successful operation of the plant must be a source of gratification to all concerned.

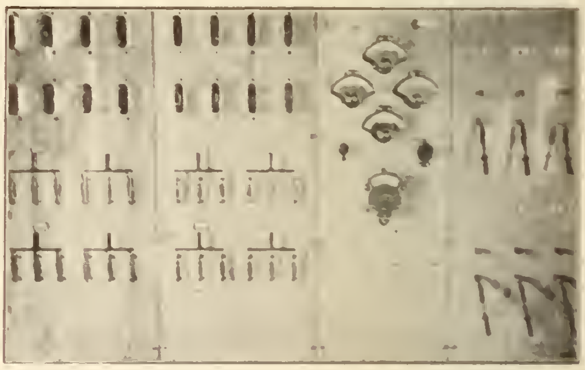

Fig. 7.—Switchboard in Sub-Station.

THE BANQUET.

In the evening a banquet was served by the Lindsay Company in a large hall in the town, which was prettily decorated for the occasion with flags and bunting. Probably 200 persons were present. The menu card was enclosed in a neat khaki cover and contained a list of good things sufficient to satisfy the most exacting appetite.

The chair was occupied by Mr. J. D. Flavelle, president of the Lindsay Board of Trade, and the vice-chair by Mr. B. F. Reesor. Letters and telegrams of regret at their inability to attend were read from a number of distinguished personages, including Mr. Frederick Nichols, general manager of the Canadian General Electric Company, who was represented by his assistant, Mr. Geo. Watts. The toast list included : "The Queen" ; "Our Manufacturing and Commercial Interests" ; "Our Municipal Institutions" ; "Electrical Enterprise" ; "The Bench and the Professions," and "The Press," all of which were fittingly responded to. A noticeable feature of the speeches was the unanimity in commending the directors of the Lindsay Light, Heat and Power Company for their energy and business acumen in carrying to completion the enterprise which was responsible for the occasion. In responding to the toast of "Electrical Enterprise," Mr. C. H. Mitchell pointed out that the first stone of the undertaking had been turned within the last eight months, while at the great Niagara Falls the people had been waiting for the development of the power there for as many years. He said that all present might not be aware that the electric lights and fans in the hall were being supplied by current generated at Fenelon Falls. He believed that the development of water powers for the generation of electricity would result in the greater development of the mines near the town. He was certain that in the near future mining by electricity would be proven to be a practical success, as well as a laboratory success which it now is. After the disposal of the above toasts the company were asked to drink the health of the Lindsay Light, Heat and Power Company. This brought responses from Messrs. Sadler, Reesor and Stewart, and the evening closed with the singing of the National Anthem.

MR. B. F. REESOR.

MR. B. F. REESOR.

Mr. B. F. Reesor, managing director of the Lindsay Light, Heat and Power Company, a portrait of whom is here shown, first launched into the electrical business in the year 1886, when he installed an arc lighting plant in the town of Newmarket, Ont. At that time very few towns in Canada could boast of having their streets and places of business lighted by electricity. But Mr. Reesor was confident that electricity was the coming light. After successfully operating the Newmarket plant for a few years, he cast about for a larger field of operation, and finally decided to locate in the enterprising and promising town of Lindsay, where a favorable opening seemed to present itself. Notwithstanding that a gas plant of considerable dimensions was already in operation there, the reception given to the electric light was such that in a very short time his most sanguine expectations promised to be realized. The capacity of his electrical plant was speedily taxed to the utmost, necessitating the insallation of a duplicate plant. In less than two years after this increase his business expanded to such an extent that he was once more compelled to enlarge. About this time an opposition electric plant was installed in the town, and the two concerns were operated with considerable vigor and varying profits until July, 1895, when, as stated elsewhere, a joint stock company was formed and the opposition electric and gas plants absorbed by Mr. Reesor's company.

The completion of the long distance plant of the Lindsay Light, Heat and Power Company, one of the finest in Ontario, is but another indication of the progressive policy characteristic of Mr. Reesor. In him the company have a manager whose business ability, coupled with his extended experience in electrical matters, are sufficient to ensure the commercial success of the new plant.

THE USE OF ACCUMULATORS.

MONTREAL, May 26, 1900.

Editor ELECTRICAL NEWS :

DEAR SIR,—In your April issue you make an editorial plea for accumulators. It is my purpose to point out a few reasons why they are not in more general use in Canada :

1st. Prime cost, the accumulator plant generally equalling in expense the engine, dynamo and wiring, after adding duty and freight. Considering the materials used in the construction of accumulators, there does not appear to be any valid reason why this should be, except we place it to patents acquired, litigation, and high running expenses of some of the manufacturing companies.

2nd. The number of alternating plants in use in Canada, accumulators furnishing as they do direct current, could not be used with transformers.

3rd. Accumulators, unless they receive (not ordinary but) skilled attention, are the most unmitigated nuisance known to the electrical fraternity, and unfortunately seven times out of ten they do not get that attention.

One other objection, which it is unnecessary to classify, may prove of interest. A certain large and wealthy public institution in Canada, any one of whose directorate could buy up, "lock, stock and barrel," a fair-sized electrical manufacturing business without emptying his pocket to any extent, received the following terms and a quotation on accumulators, which they were desirous of trying : "50% with order, 25% on shipment, balance three days after receipt of goods!" This was from the United States; needless to say it was refused. Moral—Buy in Canada.

Yours truly,
"ANTI-ACCUMULATOR."

The Chambly Water & Power Company will, it is said, materially increase their power plant at Chambly, and also develop another power of some 30,000 horse power. When the proposed improvements are completed, the company expect to have 30,000 horse power fully developed.

The United Electric Company, Limited, of Toronto, are working their factory day and night. One large contract which they have to complete in the near future is for Messrs. Lever Bros., Limited, for their Sunlight soap works now being constructed in Toronto. This contract comprises a 200 h. p. generator and some 15 specially designed cast steel iron-clad dust proof motors, to meet the requirements of the manufacture of their products.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Canadian Electrical Association. IN consequence of the recent disastrous fire at Ottawa, where it had been arranged to hold the annual convention of the Canadian Electrical Association, it has been deemed advisable to postpone the meeting until September. A notification to this effect has been sent to the members. The place and exact date for the Convention have not as yet been fixed, but will be decided upon at an early date, when announcement of the same will be made.

The Responsibilities of Telephone Companies. A PECULIAR action has been brought by George C. Stone and wife, of Ohio, in the United States Court at Savanah against the Southern Bell Telephone Co. The plaintiffs owned a winter residence at Thomasville. At about two o'clock one morning they discovered that their home was on fire and undertook to call the fire department through the telephone, but could not get a response from the central office. Thinking it possible that their own telephone might be out of order, they went to their neighbors, but with the same result. Time was wasted in this way, and the fire obtained such headway that, when the fire department was finally communicated with through a messenger, it was impossible to put out the flames, whereas, had it arrived promptly, it is claimed the fire could have easily been extinguished before any material damage had been done. The plaintiffs state that they were subscribers to the telephone company, as was also the Thomasville fire department, and that it was the business of the company to furnish to each of its subscribers means of communication with all the others by means of the telephone at all hours of the day and night. Hence they claim damages from the company in the sum of $26,000, the value of their property. If claims of this nature are allowed by the courts the telephone companies will find it necessary to revise the terms of their agreements or go out of business.

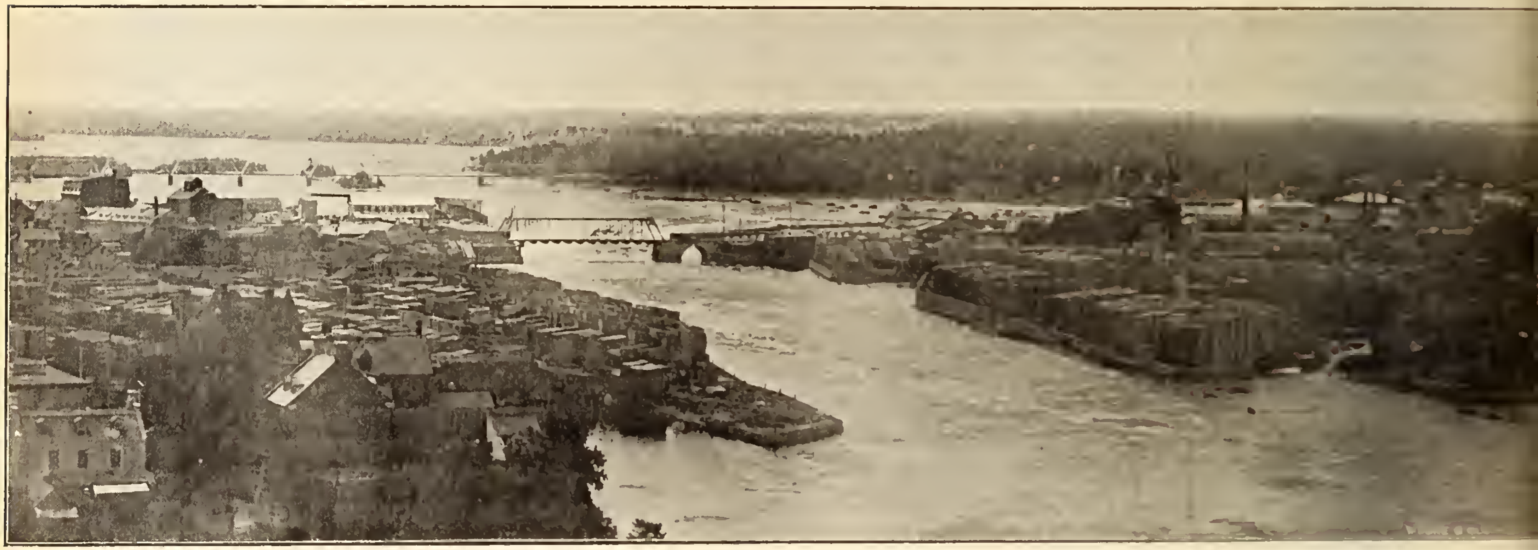
The National Electric Light Association. THE twenty-third annual convention of the above association held at Chicago on May 26th, 27th, and 28th, brought out a large attendance. Judging by the published reports, the proceedings were characterized by an earnest purpose to solve some of the more difficult problems which confront those connected with the management of electric lighting companies. Without neglecting the social features, which are a necessary part of the programme of such conventions, the more practical side of the meeting received perhaps closer attention than on some former occasions. It has come to be recognised that there are important objects to be attained by an association of this kind, and that its continued existence will depend upon the degree of earnest attention bestowed upon them. On the recommendation of the committee on standardization of electrical apparatus, the association endorsed the classification and rating of the various kinds of electrical apparatus, as defined by the American Institute of Electrical Engineers, whose recommendations are said to be already commonly recognized and followed by the manufacturers. Following the reading and discussion of a paper by James B. Cahoon, of Syracuse, N.Y., on "Uniform Accounting," a resolution was passed requesting the executive to appoint a committee to formulate a system of uniform accounting and report at the next annual meeting. Mr. Insull, a former president of the association, declared himself to be strongly in favor of uniform and public accounts, that the people may see exactly what the profits of the electric-lighting business are in the case of each company. If municipal ownership must come, he said, let the business of the central-station company be bought out by the city at a fair valuation, determined by an equitable system of accounting. A committee was appointed to determine the best method of analyzing fuel gas. A recommendation to Congress to pass the bill now before that body to establish a national standardization bureau was adopted. Pending the establishment of such a bureau, the association is arranging to have standard 16 c.p. lamps of 110 and 220 volts prepared at Columbia University for the use of members. A committee is also preparing for publication a specification and drawings for a standard photometer room and its equipment, and has under consideration a standard form of simple photometer. The committee appointed to consider the subject of grounded circuits gave it as their opinion that while the permanent "grounding" of one side of the secondary circuit is not an absolute preventative of accidents to person and property, yet it is a step in the right direction, and, if adopted, will add greatly to the safety of the public, and reduce the hazards attending the transmission of electrical energy by what is known as the alternating or transformer system. Mr. James B. Cahoon, of Syracuse, N. Y., was elected president for the ensuing year, and we are pleased to note the election of Mr. Charles B. Hunt, of London, Ont., as a member of the Executive Committee. It is rumored that the next convention may be held in Buffalo in connection with the Pan American Exposition.

Trade Opportunities in the Oriental Market.

UNTIL very recently the eyes of Canada were turned almost exclusively towards the east, and her thoughts occupied with commercial matters in Europe. During the last few years it has occurred to many that the Pacific ocean, instead of being the back road from the country, might become a highway fully as important as the Atlantic, and this idea is certain not to be disappointed by results. Trade with Australia, China, Japan, Malaya and Polynesia is no mean prize to strive for, and the splendid Pacific highway at our doors places us in a position to compete favorably with any country. The rapid advances made by the United States and Japan in their Oriental trade shows that business methods adjusted to the established ideas of the east will bring a quick return, and that the lack of flexibility inherent in British trade methods is resulting in the loss of the previous overwhelming commercial supremacy. If Canada is to take that part in the Oriental market which should be expected owing to her favorable geographical position, it will have to be brought about by a careful study of the existing and prospective conditions and demands and by enterprise in pushing sales. Many discussions have taken place regarding the trade possibilities of China, and as many diverse opinions have been expressed, varying from the optimistic idea that the millions of China represent a market for our exports equivalent to a similar population in Europe, to the pessimistic opinion that these Chinese millions will eventually swamp our markets by their cheap productions. Both of these extreme opinions are based on the supposition that the country has been opened up to trade and that foreign investments have been rendered secure. The truth, as is generally the case, appears to lie between these extremes, for on the one hand no one who knows in any degree the conditions existing in the East will allow that its ability to absorb Western products is at all commensurate with its population, and that any deductions made from results in European countries are very misleading. On the other hand, Japan has progressed far enough to act as an object lesson in the increased cost of labor which results from an increase of production, and, speaking generally, it will be conceded that when a nation has arrived at some state of stability in her manufactures, the labor cost of the output will not be found to vary from the standard all over the world. For instance, labor in Europe is cheaper than in America when reckoned by the cost per hour, but it is found that in spite of this fact the labor cost of turning out manufactured articles is not very different owing to the greater rate of production per hour of the American artisan. This equalizing effect will be found to act as a corrective, and it does not appear at all probable that our western commerce is in danger of extinction at the hands of Oriental competition. The Oriental will be a keen competitor, but judging from his character he will not originate, but will be a very successful copyist. The initiative will be found without doubt in Europe and America.

Apart from China and the French colonies in the East, trade there is less restricted than in Europe. In China the unwillingness of the ruling classes to admit the foreigner, the insecurity of capital, the fluctuating currency, and greater than all, the poverty of the millions, are the great obstacles in the way of the western trader. These are obstacles that cannot be appreciated at their full value without a knowledge of the Chinese character, of its inertness, its placid content with things as they are, its sense of superiority over the Barbarian. Under these existing conditions no opening of the trade door will take place from within, but the country will have to be burglarized by the Occidental nations, and this will probably not be long deferred. What form the forcible entry will take is not apparent, but it appears that as it requires an Asiatic to deal with an Asiatic, Japan and Russia are best fitted to obtain the advantage, and to hold it when obtained. If the open door policy prevail there will be large openings for railway enterprise. Many lines are already projected, but the question as to whether they would pay in many cases is exceedingly problematical, as China has a tremendous canal system, with cheap native labor as the motive power. However, many will be built, and this will require the services of many engineers and great quantities of materials. In the mining field the prospects are exceedingly good, the country having coal in many provinces and minerals in abundance. This, with cheap labor, will stand in the way of great importations of raw materials, and whatever staples are required will be manufactured in the country, so that given the open door policy, the first effect would be the importation of engineering materials and machinery, but it seems improbable that any great increase in staple imports could take place. This lesson may be learned from the history of Japan, where imports are decreasing and exports increasing—although the process in China will be very much slower.

With the exception of the larger electrical machinery, Japan can and does manufacture for herself. China at the present does not know that she requires any, and the other Eastern countries, while dimly conscious of the advantages of electric light and transportation, are apparently too inert to take the question up for themselves. It does appear, however, that live concerns going into the business as a specialty and covering the whole electrical field would be able to show good results, even at the present time, especially in small lines such as fans, bells, telephones, etc., the installation of ship plants, etc., with an occasional local plant, and perhaps an electric railway or two. The methods of selling electrical apparatus as at present carried on is very crude, large business houses handling the apparatus as they would hardware, without pushing sales, and being without the special knowledge which is required for this work, there are continual troubles with apparatus, and, generally speaking, there is no life in the trade. In many other lines the same methods prevail, and there is no effort made to thrust manufactures under the eyes of the customer and make trade. The Canadian Pacific Railway Company, in establishing the splendid steamship service to the East, has done much for Canada and Canadian trade, and it is owing to this fact that most of the Europeans and many of the Orientals have crossed Canada, and its products are known and could be largely extended in this field where enterprising management is seldom met with.



General View of the Chaudiere District, Showing Seat of the Recent Fire.

THE HULL-OTTAWA FIRE.

Presented herewith are some views bearing upon the disastrous fire which occurred in Ottawa and Hull on April 26th last by which the electrical interests of that city suffered severely. The first illustration will give the reader a general idea of the magnitude of the fire and of the extent of the fire-swept district. Figure 2 is a view from Parliament hill of the fire while in progress, while the third illustration shows the ruins of the burned power house of the Ottawa Street Railway. The Street Railway Company had two power houses, the one recently built being a fire-proof construction and containing a 1,200 kilowatt generator direct connected to Stillwell-Bierce horizontal turbines. The roof of this building was not built on an absolutely fire-proof plan, being of corrugated iron laid over wooden rafters. The intense heat caused the roof to melt, the blazing mass falling upon the generator, but, it is said, without injury to it or any portion of the electrical plant. The old power house which was destroyed was operated by steam, and was to have been used as an auxiliary to the new power plant.

The Ottawa Electric Company suffered the loss of their four sub-stations, including the arc light station. They estimate their loss at $100,000. The work of rebuilding their plant is progressing rapidly, under the superintendence of Mr. A. A. Dion. Considering the great destruction, the customers of the company have suffered very little inconvenience, as new machines arrived the next day and were set up in a fire-proof building, owned by Mr. J. R. Booth, and once used as a saw mill. These machines are now being temporarily operated by two water wheels loaned for the purpose by Mr. Booth.

The destruction of a large portion of the plant of the Ottawa Electric Company has revived the agitation on behalf of certain members of the city council for the purchase and control of the plant by the municipality. Some months ago a special committee was appointed to report on the advisability of purchasing a municipal plant. The price at which the Ottawa company offered to dispose of their property to the city did not meet with the approval of this committee, who contend that in some respects the plant was not up-to-date. Now that the company are installing new and modern machines, it is thought that the present is an opportune time to renew the negotiations.

Another possible result of the fire is said to be the establishment of a large central power house at the Chaudiere. A scheme is announced to be on the tapis, the object of which is to secure the amalgamation of the manufacturing interests for the purpose of erecting a large power house to supply electric energy to the various industries in Ottawa and Hull adjacent to the Chaudiere. It is pointed out that the carbide establishments will require considerable power, and it is thought that it would be possible to induce a number of new industries to locate there.

It has been announced that the Slave Lake Power Company, which purposes developing the water power at Slave Lake falls and transmitting electric power to Vancouver, B. C., have accepted the offer of the London Gold Fields Company to provide the necessary funds for the project. From this it appears that the proposition is likely to be carried to completion.

BELTS AND PULLEYS.

THE following questions are asked by a correspondent of Modern Machinery:

(1). How shall I determine the exact amount to cut out of a belt where a small pulley has been substituted for a larger one? (2) Is their gain or loss of power where two large pulleys are removed from shafts that run at the same speed, and a smaller one substituted, keeping the speed constant? (3) Which side of the belt should be put next to the pulley, and why?

View From Parliament Hill of the Hull-Ottawa Fire While in Progress.

The answers are as follows: (1) We advise you to use a tape line or a cord that will not stretch, and draw it over the pulleys, thus finding the exact length needed. If the new pulley is not much smaller than the old one, their respective circumferences may be calculated, and one-half of the difference taken, but if the diameter is very much less than before, the change in the angle of the two sides of the belt will affect the result. Therefore, the tape line method is the safest. (2) If you mean to ask whether more or less power can be transmitted, we should say less, for the belt speed is reduced and less surface is in contact with the pulleys, both of which are factors in the calculation. If you mean to ask which will require the most power to drive, there will be a slight difference in favor of using the smaller pulleys. (3) When a double belt is made, the hair or smooth sides are always put outward, so that it makes no difference which way the belt is put on, except on account of the rivets, and this shows plainly what the belt manufacturer thinks about it. If a single belt is examined it will be found that the rivet heads, which should run next to the pulley, are on the hair side, thus showing that the maker intended this side for the pulleys. The matter is in much dispute among machinists and mill men, and it probably always will be.

The Hull-Ottawa Fire—Ruins of the Street Railway Power House.

The Sydney Record states that the Sydney Gas & Electric Company have just put in a new 200 light dynamo and a 100 k.w. S.K.C. two-phase generator, a 250 h.p. tandem side-crank engine, and a 250 h.p. improved Mumford boiler.

The Electrical Construction Co., of London, Limited, have recently received orders for nine motors of various sizes from their agents in Montreal.

A by-law was carried on May 28th authorizing the council o Morrisburg, Ont., to acquire water privileges from the Dominion government and to construct electric light and power works The vote stood 141 for and 16 against.

MONTREAL

Branch Office of the Canadian Electrical News,
Imperial Building,

Montreal, June 2nd, 1900.

That something is "in the wind" between the Royal Electric Company, Chambly Electric and Manufacturing Company, and the Montreal Street Railway Company, can be fairly taken for granted if there is any truth whatever in the many rumors around town. Some of these rumors have been denied in part, but only to crop up again in some other form and somehow refuse to be completely drowned. Names of prominent shareholders connected in the past with one concern are suddenly brought forward as acquiring stock now in one of the others. Some of the reports no doubt originate in the brains of our St. Francois Xavier street stock-brokers, who seem to delight in playing a sort of battledove and shuttle-cock game over Royal Electric and Montreal Street Railway stock, but if the latest report given on excellent authority be true, that the Chambly Company intend building a dam further up the river from their present one, then the statements of local members of the electrical fraternity bear the stamp of possibility, viz: It is stated that the Montreal Street Railway directors have been watching closely the development of both the Lachine and Chambly water powers with a view to utilizing at least a portion of one or the other company's output. They saw that the Lachine Company had considerable ice troubles their first winter, and also that the Chambly Company, who had this experience to profit by, did not entirely succeed in freeing themselves from ice troubles when they ran through their first winter. The Montreal Street Railway have also no doubt seen that the Lachine Company have run through their second winter without a hitch from ice trouble, and can see the precautions being taken by the Chambly Company to prevent any trouble whatever arising from this source again, as well as the projected works for increased power. Under the circumstances it is highly possible that they should wish to make use of this cheaper method of producing power, and have now sufficient confidence in the scheme to warrant their allying themselves, naturally to the company with whom they are most intimately connected, i.e., Chambly Electric and Manufacturing Company and Royal Electric Company. As to these two companies themselves, as one cannot live without the other, it would surprise no one if they amalgamated, in fact, it is almost a foregone conclusion. That the Montreal Street Railway, however, intend closing down their present steam power house in the near future is, as Kipling says, "another story."

ELECTRICAL SUPPLY HOUSES.

It is not so many years ago that the well-known firm of Munderloh & Company went into the electrical supply business. Formerly the firm handled glassware and a choice line of dry goods specialties. They also acted as agents for the Hansa line of steamships, and their late senior partner was the respected consul of the German Empire. This firm, however, noting the strides electricity was commencing to make, a few years ago decided to try and take a hand in the game—and with astonishing success. First, their action was a wise one, namely, to secure some person capable of handling this new branch of their business who fully understood it, and their happy choice fell on Mr. John A. Burns, who is a Montreal boy and a McGill graduate, having passed with honors and a degree of B.A. Sc. One of their first and best agencies is probably that of the General Electric Company, of Berlin ("Allgemeine Elektricitats Gesellschaft"), whose products, notably the A. E. G. well known incandescent lamp, they still continue to handle. Mr. Burns soon perceived that if he wished to avoid the formerly slurring expression "made in Germany," that he must educate his German manufacturers to produce the shape, style, etc., best suited to this market. It is a well known fact that the German workman can imitate almost anything, if given the opportunity and the price to do so. In this case the opportunity was given and the directions furnished to make a first-class high-priced (i.e., for Germany) article. The success of the scheme is evident, for although formerly the A. E. G. Company sold an enormous quantity of lamps in Europe, the shape, base, style, etc., did not take here, but after the "coaching" they received the result is that their American pattern lamp has a large sale, not only in Canada but in the neighboring republic. Mr. Burns has also succeeded in importing a two-wire porcelain cleat made according to specification, which surpasses in appearance any cleat produced in this market or in the United States. Messrs. Munderloh & Company also carry a full line of annunciators, electric light shades, cut-outs, batteries, switches, etc., from prominent United States centres, and have just lately started a manufacturing department for fixtures, brackets, and the like. The designs are mostly the work of Mr. Burns, who is a "worker," and spares neither trouble nor time to push forward his department. To use the words of one who knows a fixture—"their excellent finish and perfection in lacquering, combined with solid mechanical work, would put to shame some large Canadian houses who have been longer in the business and who make more pretence at fixture-making." It is understood a catalogue is in course of compilation. As Messss. Munderloh & Company stick to their own legitimate business and do no contract work, they have on their books a large number of contractors' names in Montreal and throughout Canada.

Many years ago, when incandescent lamps were more of a novelty than they are to-day, and when their "novel" price was kept up by those "in the ring," a gentleman of electrical aspirations, who will be nameless (as it will suffice to say that he never became friendly with any of the electrical fraternity, was more famed for his "avoirdupois" than for celerity, and has somehow been lost track of in the grand race for prominence in matters electrical,) got hold of an Austrian or Hungarian lamp agency. Seeing, evidently, that he could not "work" it alone, he sought for some one of more ability, and luckily happened to hit on John Forman, now of electrical supply fame in Montreal. Mr. Forman, with his natural shrewdness, it is said, declined the assistance (?), but offered good money for it to run alone, which history says was accepted. We here lose track of the electrical aspirant (sic) and turn to John Forman. So far as we are aware this was Mr. Forman's first venture in the electrical field. He was then, if memory serves aright, occupying chambers in the Chesterfield building on St. Alexis street. Seeing the possibilities before him, Mr. Forman took up other agencies, such as the Ediswan Company, and Crompton & Company, of London, Eng. He then opened with a well selected stock on Craig street, about number 650, moving some months later to the old stand of T. W. Ness at 644 Craig street. Here Mr. Forman, seeing the delays unavoidable with English agencies, turned his eyes to the United States also, and added many valuable lines to his already growing list. Just a few months ago Mr. Forman moved his business into the elegant building further west on Craig street, vis a vis to Alexander street, where he has a general electrical supply stock that would be hard to beat. Motors, push-buttons, switches, batteries, wire, bells, etc., are to be seen on the premises. When the Canadian Bryant Company wound up their business in Montreal, their stock, assembled and unassembled, was purchased by Mr. Forman, who continues to supply their well known types of cut-outs, sockets, rosettes, etc. Among Mr. Forman's latest acquisitions in the way of agencies may be mentioned those of the Gordon (formerly Gordon-Burnham) batteries, and the Lawrence Gas Fixture Company's electroliers, brackets, ceiling pieces, etc. For this latter agency he has, at considerable expense, fitted up a special show-room, handsomely and tastefully decorated. The colors of the decorations have been well chosen so as to make a telling effect on the fixtures, which in themselves are certainly choice and of late design. It is said that the total equipment of fixtures and brackets for the residential flats built by Mr. M. S. Foley on Dominion Square, have been furnished by Mr. Forman. From the foregoing it will be seen that any buyer will be well rewarded by paying Mr. Forman's establishment a call, and he will have to ask for something rather out of the ordinary if it cannot be shown him there.

Mr. R. E. T. Pringle, son of the well known hydraulic engineer, Mr. Thos. Pringle, and now possessor of one of the largest electrical supply houses in the Dominion, is well versed in electrical industries, having at one time occupied the post of superintendent in the factory of the Royal Electric Company. His establishment, which lately comprised two stores, one on St. James street and one on Craig street, has been now gathered together into the Craig street premises, which were much the larger of the two. This consolidation is appreciated by customers and gave Mr. Pringle an opportunity to put in, as he has done, a well selected and exceedingly varied stock English goods, such as decorated push buttons, counterweights, etc., and American goods such as Patrick, Carter & Co.'s annunciators, Western Electric Co.'s lines, etc. In the Canadian goods, Mr. Pringle handles all the Packard specialties, such as transformers, lamps, and meters, and last but not least, the C. P. specialties. The trade mark

"C. P." is quoted by some as meaning "Canadian Produce," and by others as Cary & Pringle (Mr. Cary being the well known manager of the Packard Company.) Be this as it may, the trade in general owe them a debt of gratitude, for at the time this line of C. P. rosettes, sockets, cut-outs, switches, etc., were put on the market, we were just about in shape to be dictated to by a large United States combine, but C. P. spoiled the little game entirely. Mr. Pringle handles enormous quantities of wire, the weatherproof lines from a noted Canadian factory, and the rubber covered from a prominent United States concern. The popular sales manager for Mr. Pringle is Mr. Geo. Rough, who is well acquainted with the business, having taken a hand at it himself in the past when in St. Jo, Miss. Mr. Rough is a Montreal boy and eminently successful in making sales. Buyers calling at Mr. Pringle's will have to be hard to please if they cannot find what they are looking for, or if they have anything to cavil at in their treatment. We hear a good deal from supply houses across the line when they make a big sale; they are apt to print fac similes of cheques they receive for their goods, etc. It is a fact, however, that such items are of every-day occurrence with R. E. T. Pringle, and no fuss made over it either; in fact, were it not for this quiet manner in which their business is done, this item could be greatly extended, but their policy is not to blow trumpets.

NOTES.

We hear that Mr. George Hill, formerly employed by John Forman, electrical supply dealer, is now no longer with that firm.

Mr. John Shaw, of the Montreal Electric Company, who has been more or less of an invalid for six months past, is now able to put in a daily appearance at the office.

Mr. N. L. Piper, of Messrs. Noah L. Piper & Sons, Toronto, manufacturers of reflector shades, etc., is doing a good business with the electrical supply dealers in Montreal, and no representative is more esteemed. Mr. Piper is a man of few words; he sells his goods on their merits, and stands behind them.

The setting in of warmer weather seems to be having its effect in developing the usual spring crop of mushroom electrical contractors. There are many around already soliciting contracts who do not appear to know the difference between a cut-out and a socket. It is rather a pity that the winter is so severe in Montreal, so many "promising" saplings wither away before they have time to make a good sized tree.

Mr. Wm. Allan, the veteran engineer and dynamo tender at the Canadian Pacific Railway plant, Bisson street, has, we hear, resigned his position, to take a similar one with Messrs. Tooke Bros., St. Henri, whose electrical equipment has already been described in these columns. Mr. Allan has the good wishes of his electrical friends in his new sphere.

The promoters of the Shawinigan Falls plant speak of transmitting power to Montreal. As the distance is 80 miles, some electricians doubt if it will be a commercial or rather financial success, taking into consideration the high voltage required and our climate. Another phase may soon appear, and that is, that the supply of such power will exceed the demand. However, the enterprise deserves good wishes, and any electrical difficulties that may crop up will only be an incentive to their electricians to overcome, and the data on such will be sure to interest the electrical fraternity generally.

A couple of steam automobiles are in town, one belonging to Mr. Dandurand, of Queen's Park "bicycle track" fame, the other to the Cycle & Automobile Company, whose office is in Windsor Hotel block. As yet no manufacturer has tried conclusions with our hills with a storage battery electro-mobile, but it is rumored that an electro-mobile is under construction in the city.

There have been of late several accidents in this city, due to the electric current. A man named Zori Daw received an electric shock while working among wires at the corner of Notre Dame and Fulford streets, and was taken to the Notre Dame Hospital. R. F. Girdwood, employed by the Royal Electric Company, had a narrow escape from death. He was engaged in making a test of some apparatus when another workman, not knowing his position, turned on a current of 6000 volts. Besides receiving a severe shock, he was badly burned, and was removed to the hospital, where he is improving. It would seem that when any such testing is being done with the apparatus at a distance from the switch, it would be desirable to have a third party mid-way between, who would act as a check or safe-guard, in case of a misunderstanding of orders called from one employee to the other. The widow of George Peace is suing the city for $10,000 damages consequent upon the death of her husband, who was killed by an electric shock at the incinerator on St. Patrick street on November 10th last. Negligence on the part of the city is alleged.

DOMES ON STEAM BOILERS.

By W. H. Wakeman.

A few days ago I fired up a boiler that had not been used for six months. After the air was forced out of it by the steam, through an open safety valve, the valve was closed and pressure allowed to accumulate. It was not tight, so I raised the lever and let steam blow freely through it. At first this steam was dry, but after about 30 seconds the discharge pipe was nearly half full of water that was coming out with the steam. As this boiler has no dome on it my attention was called by the incident to the difference between boilers that have domes and those that have none. In the above mentioned case the boiler was not flooded with water, as there was only two gauges, or no more than would be carried in practice.

The philosophy of the water coming out with the steam is as follows: When the safety valve was lifted enough to give the full capacity of pipe, there was a very great rush of steam through it, which lowered the pressure on the surface of the water immediately under the steam pipe. I do not mean to say that it was lowered very much, for it probably was not, but a difference of one pound is enough to cause trouble; for, as the pressure is maintained on the remainder of the water surface, it forces the water directly below the steam pipe out with the steam. Domes are put on boilers to obviate the evil, for they afford a very much larger opening for the escape of steam, consequently the velocity is less, and the water below the opening is not forced up with the steam. It is not assumed that the shell is cut away for the full size of the dome, as that would weaken the shell more than is necessary, but an opening that is twice the diameter of the steam pipe should be provided. Where there is a manhole in the dome, the shell is cut away enough to make an opening as large as the manhole. Those people who object to domes point out the fact that an opening of this size greatly reduces the strength of the boiler, but there is no good reason for this remaining so.

A boiler without a dome is usually fitted with a manhole in the shell, and this is reinforced with a frame that is supposed to be as strong as the metal in the shell was before it was removed. Suppose it was decided to put a dome on his boiler, and to locate it over the top manhole. Could any boiler maker consider it necesary to remove the frame as useless? I think not, for he would say that it supported the shell and made the whole structure stronger than it otherwise would be. This being true, why is it not good policy to put on a supporting frame inside of the dome when a boiler is built? If this was done the claim that a dome weakens the shell of a boiler would no longer be tenable; and this is the principal objection to having one included in the specifications. The claim that it acts as a reservoir for steam, to be used when wanted, as presented by those who favor it, is not worthy of serious consideration on account of its small capacity; neither is the objection offered to it by the opposition, who say that it acts as a condenser, as the surface exposed is not large, and it should be protected by sone good covering. The conclusion of the whole matter is, therefore, that a dome furnishes dry steam to the engine as above described, and it does not weaken the shell when properly constructed, any more than it does to put a manhole in shell at some other point.—The Wood-Worker.

ENGINEERING and MECHANICS

EXAMINATION OF ENGINEERS.

By W. H. Wakeman.

The examination of steam engineers for licenses on land or sea, or for admission into the various societies that are supported for the purpose of benefitting the craft, is always an interesting subject, and to prospective candidates for these honors it is peculiarly fascinating. As a rule an examining board does not adopt a list of questions for those to answer who apply for examination, although it may have such a list from which to make selections for use at various times. This makes it practically impossible to inform the candidate in advance of what he will be required to answer. He must therefore gain a general knowledge of the business, and having become well grounded in its fundamental principles, apply them to the solution of problems presented, use good judgment in formulating replies and never get nervous or excited.

All men are not qualified to pass these examinations, neither is every man who finds himself a member of an examining board qualified to discharge the duties of that important position.

Sometime ago it was the writer's privilege to attend an important meeting of engineers, a feature of which was an ideal examination of a candidate for admission to their ranks, and as much interest in the questions asked has been manifested, an article in which these questions are fully answered will prove benificial to many others interested.

There were twenty-five questions propounded, and while the replies given here are more elaborate than can be allowed for an ordinary examination, they are none too explicit to convey a full and correct knowledge of the subjects treated. The questions, answers, and explanations follow :

1. How would you proceed to inspect a boiler?

A. Every part of the shell, tubes and heads that can be reached should be examined and a thorough search made for places affected by internal or external corrosion, pitting, cracks, blisters, and bagging caused by lack of water.

Internal corrosion may be caused by steam and water leaking into a not in use, or by certain impurities in the feed water while it is under pressure every day. External corrosion is caused by water dripping on the outside of it from leaky steam pipe, valve stem, or on account of holes in the boiler house roof.

Pitting is caused by impure feed water, and sometimes by allowing a boiler to stand many days with warm water in it, although said water may be pure. In some cases small blisters are raised on the metal, and when these are broken, pits, or hollow places are found under them.

Cracks are caused by unequal contraction and expansion, by injudicious use of the drift pin, and by expanding tubes into the heads. Very close examination will disclose their presence, and sheets and heads that are imperfect in this respect may be detected by means of a light steel hammer in the hands of an experienced engineer, as when they are struck the sound differs from that given out by sound iron or steel.

Blisters are caused by imperfections in iron plates, for where several pieces are rolled together to make a boiler plate the weld may not be perfect throughout the whole piece, and when put into hard service the different layers become separated and a blister is formed. If the defect does not not extend deep into the plate it may be trimmed, its extent carefully noted, and if the remaining portion is as strong as the riveted joint, no further precautions are necessary, except to make sure that it does not spread. If the blister is large and deep it will be necessary to cut it out and put on a patch.

The bagging of a sheet is caused by lack of water in direct contact with it. This does not necessarily mean that the water line has been allowed to fall so low that the part has been uncovered, for grease may have collected upon the sheet and thus effectually prevented the water from retaining it, the result of which is that it has been overheated and the pressure has bulged it out, or caused a "bag" to appear.

All of the rivets should be tested in order to detect loose ones, and every brace examined, for if one is loose or broken it will cause unnecessary stress to come upon others, which may strain or break them. While the engineer or inspector is inside the boiler, he should see that all the pipes connecting try cocks, water and steam gauges are free from rust and sediment, and if an excessive amount of scale is on the tubes and shell it should be removed. The safety valve should be examined and tested in order that it may be known to be in good working order, and all superfluous weights removed from its lever.

2. A boiler is sixty-six inches in diameter, the plates are three-eighths-inch thick, and have a tensile strength of 60,000 pounds per square inch of sectional area. The strength of the seams is 75 per cent. of the solid plate and the factor of safety is 5. What is the safe working pressure?

A. One hundred and two pounds. It is calculated as follows (for every applicant for a license should be able to explain the examples given him): The plates possess a tensile strength of 60,000 pounds per square inch of sectional area, but they are only three-eighths inch thick, therefore the ultimate strength of a strip one inch wide is $60{,}000 \times .375 = 22{,}500$ pounds. $(\frac{3}{8} = .375$.

A boiler plate cannot be considered stronger than its weakest part, and in this case the seam has 75 per cent. of the strength of solid plate, therefore $22{,}500 \times .75 = 16{,}875$ pounds, which is the actual strength of the plate put into this boiler, calculated from the weakest part, which is the seam. This is to be divided by one-half of the diameter, and $16{,}875 \div (66 \div 2) = 511$ pounds, which is the bursting pressure of this boiler. The factor of safety is 5, which means the bursting pressure is to be divided by 5 to obtain the safe working pressure. $511 \div 5 = 102$ pounds.

3. The area of a safety valve is ten square inches the steam pressure ninety pounds, and the distance from valve to fulcrum is three inches, and the ball weighs one hundred pounds. What should be length of the lever in order that the weight shall balance the steam pressure, neglecting the weight of valve and lever?

A. Twenty-seven inches. As the area of valve is ten square inches, the pressure ninety pounds, and the distance from valve to fulcrum three inches, these factors must be multiplied together and the product divided by weight of ball. $10 \times 90 \times 3 \div 100 = 27$.

4. Give the principal cause or causes for boiler explosions?

A. There is nothing mysterious about boiler explosions, as they are all caused by putting more pressure on than the boilers are able to carry, hence the failures. There is, however, a variety of reasons for this, as a boiler may have become weakened by abuse and unavoidable wear, until it is no longer strong enough to carry the ordinary working pressure. In many cases where boilers are not insured, the pressure to be carried is determined by what is needed to drive the engine, without regard to the strength of boiler. Some of the defects which weaken a boiler are so covered that it is impossible to detect them, and several explosions have occurred from this cause. Incorrect steam gauges and safety valves that require the use of a sledge hammer to lift them from their seats have caused explosions from over-pressure.

5. The crank of an engine is fifteen inches long and makes ninety revolutions per minute. How many feet does the piston travel in a minute?

A. Four hundred and fifty feet. As the crank is fifteen inches long, the stroke is 30 inches, so that the piston travels sixty inches per revolution, and $60 \times 90 \div 12 = 450$ feet. Some confusion seems to exist among men in charge of steam plants who are not well informed, concerning the proper way to measure the stroke of an engine, and some amusing results have been secured in efforts to calculate the piston speed under these conditions, but the above way is correct for making the calculation, and the way to determine the length of the crank is to measure from the centre of crank shaft to the centre of crank pin.

6. The initial pressure on a piston is seventy pounds and the compression is thirty-five pounds, both gauge pressures. Is the clearance half filled?

A. This is one of the questions intended to "catch the candidate, or, in other words, to offer a test for quick action in arriving at conclusions, as the reply involves the consideration of several things. When the writer first heard that question it appeared as if the intention was to ask if the compression pressure equalled one-half of the initial pressure, when both are measured from a perfect vacuum, as this is the true basis from which to start. If we take the atmospheric pressure at fifteen pounds the total initial pressure is eighty-five pounds, and the compression fifty pounds, so that the latter is more than one-half the former. Such a reply might be understood as an attempt to put an incorrect construction upon sentences that are very plainly worded, and acandidate is always justified in taking questions as they are given him. Viewing it in this light the reply would be, No.

The explanation of this is as follows : Under ordinary conditions we say that when a space is filled with steam, even if the pressure is only one pound above a vacuum, it is full, because nothing is there but steam, and yet when we bring the whole matter down to what is technically correct, a space is never full so long as it is possible to get anything more into it, therefore when steam is forced in until the pressure is thirty-five pounds by the gauge, it is not one-half full, neither is it full when the pressure rises to seventy pounds, for more can be forced into it, and it is difficult to locate the limit.

7. How do you find the ratio of expansion for a compound engine ?

A. There are two ways of doing this, one of which is to determine the volume of the high pressure up to the point of cut off, also the total volume of the low pressure cylinder. Divide the latter by the former and the quotient is the ratio of expansion for the engine. The other is to multiply the ratio of expansion in the high pressure cylinder by the ratio in the low pressure, and the product will be the total ratio. There are many engineers in charge of fine plants that do not understand this, for it appears as if the ratios of the two cylinders should be added together instead of multiplied.

Take the case of an engine with a high pressure cylinder twenty inches and a low pressure forty inches in diameter, making the areas 1 to 4, and assuming that the cut off takes place at one-quarter stroke. This makes the ratio 4 for the high pressure cylinder, because at the end of the stroke the space filled by the steam is four times as large as at the point of cut off. When the exhaust valve opens and allows the steam to go to the low pressure cylinder, it fills it at an equal pressure up to one-quarter stroke, at which point the ratio is still 4, but when the low pressure piston has advanced to one-third stroke it is 8, at three-quarters stroke it is 12, and at the end of the stroke it is 16. As it is 4 for each cylinder, it is 4 × 4 = 16 for the combined or total ratio. In this case the effects of clearance are neglected, in order to make the illustration simple and comprehensive.

8. The areas of the pistons of a three cylinder triple expansion engine are 100, 300 and 900 square inches respectively. The ratio of expansion in the high pressure cylinder is 3. What is the ratio in the intermediate cylinder? What is it for the low pressure cylinder ? What is the combined ratio ?

A. As the ratio in the first cylinder is 3 and the second or intermediate cylinder is three times as large, the cut off would take place at one-third stroke, making the ratio 3. The low pressure cylinder is three times as large as the intermediate, therefore the ratio is three for this also, and the combined ratio is 3 × 3 × 3 = 27.

Another way to explain this is to assume that the stroke of all pistons is thirty-six inches, thus locating the cut-off in the high pressure cylinder at 36 ÷ 3 = 12 inches. The contents of it up to this point is 100 × 12 = 1,200 cubic inches. The contents of the low pressure cylinder is 900 × 36 = 32,400, and dividing one by the other shows that 32,400 ÷ 1,200 = 27.

9. What is latent heat ?

A. Heat that is not indicated by a thermometer. Heat is a form of motion, so that when water is heated to the boiling point the molecules of which it is composed are set in active motion. This is indicated by a thermometer, but when more heat is applied in order to increase the motion of the molecules and throw them further apart so as to form steam, it is not shown by a column of mercury, therefore it is said to be latent or hidden.

10. What is sensible heat ?

A. Heat that is indicated by a thermometer, or that is sensible to the touch.

11. What is meant by the absolute zero of temperature ?

A. It means a temperature so low that it is impossible for it to go lower. In other words, it means when the molecules are brought to a state of perfect rest. This has never been secured in practice, and is therefore a theoretical calculation only, but it is necessary for use in many engineering calculations. By the Fahrenheit scale it is 461, by Reaumer 229, and Centigrade 274 degrees below zero.

For the Fahrenheit scale, which is the one most commonly used in the United States, it is calculated as follows : It has been determined that a quantity of mercury will shrink about $\frac{1}{493}$ of its bulk for each degree that its temperature is lowered. Starting at the freezing point, which is 32 degrees, in order to reduce its bulk to nothing it must fall about 493 degrees, or to 493 − 32 = 461 degrees below zero.

12. What is the total weight of a column of water whose cross-section is nine square inches, the height being one hundred feet and the temperature 62 degrees Fahrenheit ?

A. 389.375 pounds. As the cross section of this column contains nine square inches and it is 100 × 12 = 1,200 inches high, it contains 9 × 1,200 = 10,800 cubic inches, or 10,800 ÷ 1,728 = 6.25 cubic feet. At a temperature of 62 degrees, one cubic foot weighs 62.3 pounds, and the whole will weigh 6.25 × 62.3 = 389.375 pounds.

13. What is the difference between a continuous and an alternating current of electricity ?

A. A continuous or constant current flows in one direction only, but an alternating current (as its name indicates) changes its direction, or alternates many times per second, the number depending upon the design of the generator that supplies the current.

14. When the reading of the voltmeter and the ammeter are given, how do you determine the electrical horse-power ?

A. Multiply one by the other and divide by 746.

15. What is a volt ?

A. It is the unit of pressure in electrical work, the same as the pound is for steam pressure. When the conductor cuts 100,000,000 lines of force per second, a pressure or potential of one volt is generated.

16. What is a kilowatt ?

A. One thousand watts, and as 746 watts make one horse-power, a kilowatt is practically one and one-third horse power.

17. Explain briefly the theory of mechanical refrigeration.

A. Some liquid or gas, usually ammonia, is compressed by a mechanical device called a compressor, or by expansion caused by the application of heat, until a high pressure is secured, and the heat concentrated, after which it is removed by cold water in a condenser. Passing on through pipes until an expansion valve is reached it is allowed to expand into a much larger volume in pipes of greater diameter. As it does not contain heat enough to supply the increased volume, it attracts it from the surrounding air, in the direct expansion system, from the brine in the indirect system, thus producing a low temperature.

18. Why is ammonia used in this process ?

A. Because it is readily obtained at a moderate price, it is quickly changed from a gas to a liquid, and its expansive properties are very great.

19. What is the latent heat of ice ?

A. It is 142 heat units. It is so called because when ice is at a temperature of 32 degrees it requires the application of 142 heat units to melt one pound of it into water at 32 degrees, and when in the form of water as above stated, it is necessary to abstract 142 heat units in order to freeze it.

20. Why is salt water used in circulating pipes instead of fresh water ?

A. Because it can be reduced to a lower temperature without freezing.

21. What is a gas engine ?

A. It is an engine in which either natural or manufactured gas is burned in the cylinder in order to move the piston.

22. What is a gasolene engine ?

A. An engine in which the gas formed from gasolene is burned in the cylinder.

23. How do you determine the mean effective pressure of a gas engine ?

A. A diagram is taken and its mean effective pressure computed the same as for a steam engine, but the time during which this pressure is acting on the piston must be taken into account. If there is one explosion for four strokes, the pressure shown by the diagram must be divided by four to decide the mean effective pressure for the full piston speed, or the actual mean effective pressure for one stroke may be taken, and one-fourth of the piston speed taken when calculating the power developed by the engine.

24. What is meant by a two cycle engine.

A. It means an engine in which there is one explosion of gas for each two strokes made. The term "two stroke cycle" is much more comprehensive.

25. Why are heavier fly wheels used on gas engines than for steam engines of the same power ?

A. It is necessary to do this in order to maintain steady speed. In some engines there is one explosion for two revolutions of the machine, thus making the impulses far apart, so that in the absence of heavy fly wheels or balance wheels, to absorb and give out the power developed, the speed would be very unsatisfactory. The same is true, in a less degree, of two cycle engines.—The Tradesman.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

The Ontario Association of Stationary Engineers held their annual convention in London on May 28th, at which there was present a good representation of the certificate holders. The report of the registrar as to the membership showed 917 as the total number upon the books, of which 13 have died, 8 are blank numbers, and 154 have been cancelled, leaving 742 members on the books.

The financial statement of the treasurer showed an income, including the balance from last year, of $653.99, and an expenditure of $517.89, leaving a balance on hand of $136.10.

A full discussion of the license law and the prospect of having it passed, brought out the fact that many steam users who were at one time opposed to the measure, were now favourable to it, and a committee was appointed to further enlighten the steam users generally as to the working of the proposed act.

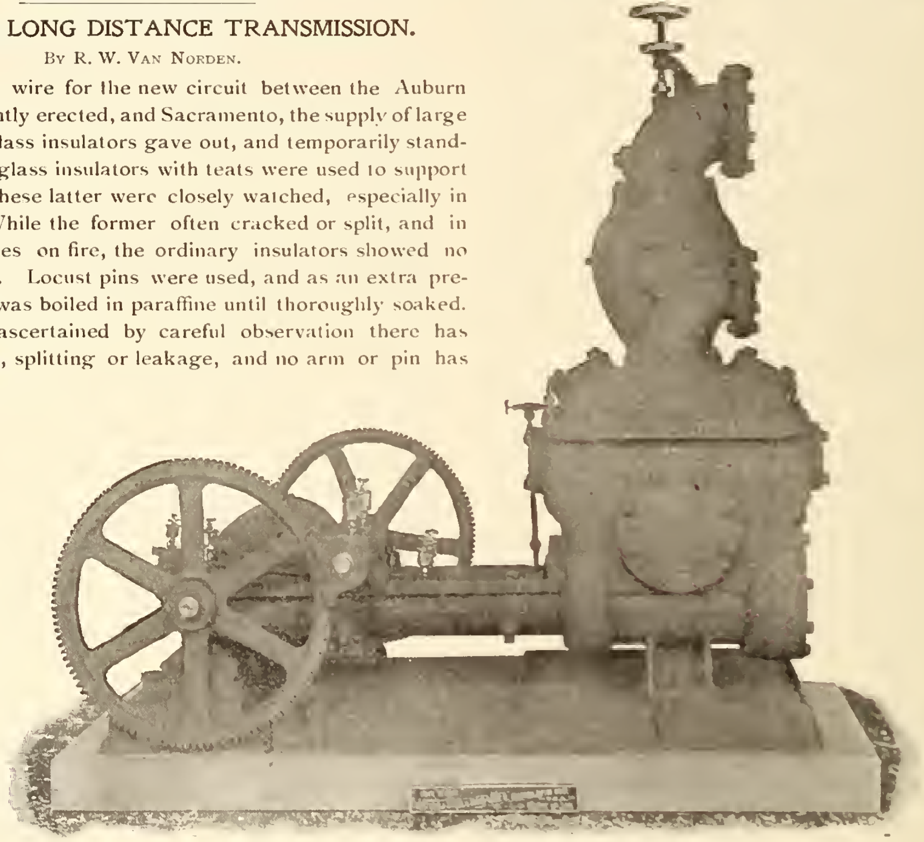
The election to fill the place of the retiring members of the board, resulted in the selection of Messrs. O. P. St. John, of Toronto, A. E. Eakins, of Toronto, A. M. Wickens, of Toronto, and Alex. Findlay, of London. The board then elected its officers by selecting O. P. St. John as president ; Thos. Elliott, of Hamilton, as vice-president ; J. G. Bain, 113 Yorkville avenue, Toronto, registrar, and A. M. Wickens, of Toronto, treasurer.

A lively election occurred for the next place of meeting, St. Thomas, Paris, Brantford and Berlin all being named, with the result that the ballot was in favor of Berlin. The usual complimentary votes to the officers were then passed, and the meeting closed in time for most of the delegates to catch the evening trains for their respective homes.

ELECTRICALLY OPERATED CONDENSER.

There was lately installed at the United States Government yard, Bremerton, Washington, an electric plant, one of the units of the plant being a special Smith-Vaile direct connected electrically operated jet condenser, as illustrated by half-tone engraving herewith. A sub-base is provided extending under the air cylinder, as well as condensing chamber, and also extended to receive a G. E. motor. The power end is provided with double reduction of gears ; the motor is provided with raw-hide pinion, and there is also a raw-hide pinion on pinion shaft of condenser. The gears are machine cut ; air cylinders removable and brass lined ; air piston is of bronze, fibrous packed and provided with expansion ring ; special priming valve is also furnished ; and the condensing chamber is provided with special distributing valve.

The condenser was manufactured and installed by the Stillwell-Bierce & Smith-Vaile Co., of Dayton, Ohio.



Smith-Vaile Direct Connected Jet Condenser.

HINTS ON LONG DISTANCE TRANSMISSION.

By R. W. Van Norden.

In stringing the wire for the new circuit between the Auburn power house, recently erected, and Sacramento, the supply of large tripple-petticoat glass insulators gave out, and temporarily standand two-petticoat glass insulators with teats were used to support a mile of wire. These latter were closely watched, especially in wind and rain. While the former often cracked or split, and in some cases set poles on fire, the ordinary insulators showed no signs of weakness. Locust pins were used, and as an extra precaution every pin was boiled in paraffine until thoroughly soaked. So far as can be ascertained by careful observation there has been no cracking, splitting or leakage, and no arm or pin has been burned or charred. The line has been cut out and thrown in suddenly every day for nine months ; but while the water in a storm hangs from the teats and drips near the wire or upon the arms, no results detrimental to the proper working of the line have been observed. Several large glass insulators have passed through severe storms without accident, though badly cracked. It is theretore a natural conclusion that boiling the pins in paraffine is of extreme importance.

The possibllity of synchronizing the machine at Auburn with the Newcastle generators, the distance between the stations being some five and one-half miles, and the line of No. 4 copper wire, was seriously questioned by some authorities, who claimed that as the capacity of the line was small, the effect would he to cause a current lag or a change in the form of the electromotive force curve and make the machines pump or altogether fall out of synchronism. Not the slightest difficulty of this nature was experienced. In fact, when Station No. 2 comes in, the operator at Station No. 1 hardly knows the moment, there being only a slight movement of the ammeters.

At present all regulation (the system is hand regulated) is done at Station No. 1. Station No. 2 starts up with a specified load, and as the general load increases, at a telephone signal Station No. 2 augments its own load 100 horse power at a time, every hour or half hour, until the maximum is reached. The operation is then reversed until Station No. 2 is cut out entirely.

By this method no water is wasted at Station No. 1, where it is valuable for irrigation, etc., while at Station No. 2 the water must flow constantly, this station being on the same canal but farther up the country.

If for any reason the generator in Station No. 2 be underexcited, the difficulty can be remedied by over-exciting the lower generators. This causes a slight flattening of the electromotive force curve, however, so that a wattless current flows between the stations, which tends to make the voltmeters fluctuate very slowly but regularly about one volt, and the ammeters become unsteady.

The distance seems to have a cushioning effect, and it is not by any means so necessary to have the generators so near in synchronism when thrown together as when side by side.

It is therefore evident that stations may be distributed over considerable distance and yet run as one, all aiding to swell the total of current to be delivered.

A COMPLIMENT TO CANADIAN ENGINEERING.

The Municipal Technical School, Manchester, England, has ordered from the Robb Engineering Co., of Amherst, Nova Scotia, a 150 h. p. tandem compound engine, to be directly coupled to dynamo from Dick, Kerr & Co., of London, for electric lighting. The order was given on the recommendation of Dr. J. T. Nicholson, Professor of Engineering, who was formerly at the Institute of Science, McGill University, and the purchasers state that this engine is to be placed with other engines of the leading British makers as an example of the best English and foreign practice in engineering.

The council of St. Mary's, Ont., have passed a by-law to provide $15,000 for the purpose of acquiring the electric light plant now owned by Mr. Reesor. The ratepayers will vote on the question on July 21st.

Mr. W. T. Steward, electrical engineer, Toronto, has removed from Temple Building to Room 38, Yonge Street Arcade. Mr. Steward has just given a valuation of the electric light plant a Galt, Ont., for the corporation.

In the report in last issue of the annual banquet of Hamilton No. 2, Canadian Association Stationary Engineers, it was stated that the response to the toast of ''Education' was made by Mr. Geddes, of the Scranton School of Correspondence. This was an error, as Mr. Geddes represents the American School of Correspondence, of Boston.

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*Paper read at the annual convention of the Pacific Coast Electric Transmission Association, San Francisco.

HANDY WIRING TABLES.

BY "W. R."

In many shops and mills where the readers of this journal pass twelve out of the twenty-four hours of each day, six days in the week, says the Stationary Engineer, they have to attend a dynamo for three or more hours per day at this season of the year. Should another lamp be wanted in some closet or over some bench, the engineer, of course, is the one to put it in. Oftentimes he may be in doubt as to the size of wire to run by which he would be insured of getting the full candle power. The tables accompanying this will show the current required by lamps of different candle power and voltages and the size of wire for a given distance in feet for any number of lamps of the two principal voltages now in use, viz: 50 volt alternating and 110 volt direct. The tables are correct and conform to the rules of the board of fire underwriters, and are the same as are used by one of the largest construction companies in Massachusetts. The tables are of such convenience in running wire that the task of selecting the proper size becomes an easy matter, and engineers having electric light work to do should preserve them for future reference. Table No. 1 shows the current in amperes required by lamps of different candle power and designed for different voltages. Table No. 2 shows the size of wire required for any number of 16 c.p. 110 volt lamps with the average loss of 2% at any distance from 50 to 200 feet. Table 3 gives similar information regarding 16 c. p. 50 volt lamps.

TABLE I.

Amperes per Lamp at Different Voltages.

Voltage.	50	60	70	75	100	110	120
C. P.	Amperes.						
10	.80	.56	.50	.48	.46	.44	.43
16	1.0	.86	.76	.74	.60	.58	.56
20	1.5	1.15	1.11	1.10	.78	.76	.74
24	1.6	1.22	1.18	1.15	.80	.78	.76
32	2.40	1.70	1.50	1.45	1.20	1.18	1.16
50	3.50	2.30	2.25	2.20	1.72	1.68	1.60
75	4.20	3.50	3.45	3.40	2.42	2.36	2.30
100	6.80	4.60	4.40	4.35	3.25	3.20	3.15

Watts per lamp = E.M.F. × current.
Ex.:—50 volts × 1 ampere = 50 watts.

TABLE II.

16 c. p. 110 volt lamps.

Current per 16 c.p. lamp, 110 volt = .56 ampere. No. 16 wire is the smallest allowed to be used by the underwriters.

No. of lamps.	Distance in Feet.										
	50	60	70	80	90	100	120	140	160	180	200
	Size of Wire, B & S Gauge, 2% loss.										
1	16	16	16	16	16	16	16	16	16	16	16
2	16	16	16	16	16	16	16	16	16	16	16
3	16	16	16	16	16	16	16	16	16	16	16
4	16	16	16	16	16	16	16	16	15	15	15
5	16	16	16	16	16	16	16	13	13	13	12
6	16	16	16	15	15	15	14	13	13	12	12
7	16	16	16	14	14	14	13	13	12	11	11
8	16	16	15	14	14	13	13	12	11	11	10
9	16	15	14	14	13	13	12	11	11	10	10
10	15	14	14	13	13	12	12	11	10	10	9
12	15	14	13	13	12	12	11	10	10	9	9
14	14	13	13	12	11	11	10	10	9	8	8
16	13	13	12	11	11	10	10	9	8	8	7
18	13	12	11	11	10	10	9	8	8	7	7
20	12	12	11	10	10	9	9	8	7	7	6
25	11	11	10	9	9	8	8	7	6	6	5
30	11	10	9	9	8	8	7	6	6	5	5
35	10	9	9	8	7	7	6	6	5	4	4
40	9	9	8	7	7	6	6	5	4	4	3
45	9	8	7	7	6	6	5	4	4	3	3
50	9	8	7	6	6	5	5	4	3	3	2
60	8	7	6	6	5	5	4	3	3	2	2
70	7	6	6	5	4	4	3	3	2	1	1
80	6	6	5	4	4	3	3	2	1	1	0
90	6	5	4	4	3	3	2	2	1	0	0
100	5	5	4	3	3	2	2	1	0	0	0

TABLE III.

Sixteen c. p. 50 volt lamps. Loss 2% both sides of circuit.

Current per 16 c.p. 50 volt lamp = 1 ampere. No. 16 wire is the smallest allowed to be used by the underwriters.

No. of lamps.	Distance in Feet.												
	25	35	50	60	70	80	90	100	120	140	160	180	200
	Size of Wire, B and S Gauge.												
1	16	16	16	16	16	16	16	16	16	15	15	14	14
2	16	16	16	16	15	15	14	14	13	12	12	11	11
3	16	16	15	14	13	13	12	12	11	10	10	9	9
4	16	15	14	13	12	12	11	11	10	9	9	8	8
5	16	14	13	12	11	11	10	10	9	8	8	7	7
6	15	13	12	11	10	10	9	9	8	7	7	6	6
7	14	13	11	10	10	9	9	8	8	7	6	6	5
8	14	12	11	10	9	9	8	8	7	6	6	5	5
9	13	12	10	9	9	8	8	7	6	6	5	5	4
10	13	11	10	9	8	8	7	7	6	5	5	4	4
12	12	10	9	8	7	7	6	6	5	4	4	3	3
14	11	10	8	7	7	6	6	5	4	4	3	3	2
16	11	9	8	7	6	6	5	5	4	3	3	2	2
18	10	9	7	6	6	5	5	4	3	3	2	2	1
20	10	8	7	6	5	5	4	4	3	2	2	1	1
25	9	7	6	5	4	4	3	3	2	1	1	1	0
30	8	6	5	4	3	3	2	3	1	0	0	00	00
35	7	6	4	3	3	2	2	2	0	0	00	00	000
40	7	5	4	3	2	2	1	1	0	00	00	000	000
45	6	5	3	2	2	1	1	0	00	00	000	000	000
50	6	4	3	2	1	1	0	0	00	000	000	0000	0000
60	5	3	2	1	0	0	00	00	000	0000	0000	0000	
70	4	3	1	0	0	00	00	000	0000	0000	0000		
80	4	2	1	0	00	00	000	000	0000	0000			
90	3	2	0	00	00	000	000	0000	0000				
100	3	1	0	00	000	000	0000	0000					

BY THE WAY.

By the courtesy of Mr. E. B. Merrill, I have been privileged to glance over a letter received by him from a friend, who is a Lieutenant with the volunteer detachment of Electrical Engineers (R.E.) in South Africa. This detachment, consisting of fifty men and four officers, was organized early in the year, and their offered services were eagerly accepted by the War Office, who granted £5,000 for equipment and apparatus. This consists of two search light trains, each comprising a steam traction engine, and two 24-inch projections, the latter mounted on gun carriages. Each train consists of twenty-three men commanded by a Captain. Each dynamo is mounted on a bracket in front of the engine and arranged for link belt drive. While the apparatus was being manufactured, the detachment were given a "send off" dinner at the Princes' restaurant in London, at which Lord Kelvin presided, and were also entertained by the Mayor and Corporation of Chelmsford. On March 16th they sailed for Cape Town. I quote from the letter the following further particulars: "Our plant is of our own design and something completely new in the field. The navy had already improvised lights by taking theirs off their decks and screwing them onto railway trucks, but their use was only for signalling, and they are tied to the railway line, whereas ours are perfectly as movable as field guns, and we are to take them right into the firing line, one idea being to cover the advance of men at night with a screen of light, and of course we would also be used in connection with heavy artillery for siege purposes. We have also got some very neat field telephone gear, and we have arranged bikes to carry reels of 22 bare copper wire, which can be paid out on the veldt at the rate of ten miles an hour if necessary. It is astonishing how little insulation is required. At some experimental runs we buried the two experimental wires in mud 10 feet apart at a road crossing, and the talking was quite distinct. We have also got a very complete equipment of tools, so that it would be a queer job that we could not tackle. We can work the lights up to a distance of one mile from the generator, the cables being arranged on drums mounted on gun wheels. As one instance of our usefulness, we could have enabled the artillery to reduce Cronje's defence in a couple of days, because he could not have had a chance to entrench at night time."

BURLEIGH FALLS POWER DEVELOPMENT.

On Monday, June 4th, upon the invitation of Mr. J. A. Culverwell, managing director of the Central Ontario Power Company, a party of gentlemen from Lindsay and Peterborough made a visit of inspection to Burleigh Falls, where the plant of the company is to be located. On arriving at Burleigh Falls, per steamer from Lakefield, they crossed over to the mouth of Perry's Creek. The channel forms the overflow from the waters held back by the large dam above, and down its course an immense volume of water was racing. Fifty yards from where the creek empties into the lake the sides of the gorge come together within a few feet, and at this point the power dam will be placed. The solid granite sides of the gorge slope up from the narrow bottom in the form of a V, affording facilities for the strongest possible construction. It is proposed to build the dam of rock and concrete. The head of water is estimated at from 27 to 30 feet. The visitors were much impressed with the immense source of power, and the purposes of the company were explained to them, after which dinner was partaken of at the Burleigh Falls hotel, and some brief addresses given by Mr. Culverwell, Mr. McLaughlin, solicitor for the company, and others.

PERSONAL.

Mr. J. W. Marr, chief engineer for the Metropolitan Railway Co., has resigned his position.

Ald. Robt. C. Pettigrew, president of the Canadian Association Stationery Engineers, was elected one of the board of managers of the Hamilton Art School at the annual meeting on May 28th.

Mr. Geo. McDonald, late electrician for the city of Moncton, N. B., has been engaged to superintend the installation of the electric power plant of the Truro Knitting Mills Co. at Truro, N. S.

Mr. Albert Mitchell, who succeeded Mr. Somerset as superintendent of the Winnipeg Street Railway, has resigned this position and has gone to Perth, West Australia, to engage in railway work.

Mr. J. Alex. Culverwell, electric and hydraulic broker, has removed from Toronto to Peterborough, having accepted the position of managing director of the Central Ontario Power Company, proprietors of the Burleigh Falls water power.

Mr. Frederick A. Hamilton, E. E., of Halifax, N. S., has been engaged by Clarke, Forde & Taylor, engineers to the Commercial Cable Company, to accompany the expedition which is to lay a cable from Canso, N. S., to New York. Mr. Hamilton expected to remain at New York to take the usual thirty days' tests.

Mr. S. Potter, superintendent of the London Street Railway, recently tendered his resignation, and we understand has been appointed chief engineer at the power house of the Toronto Railway Company. Before leaving London, Mr. Potter was made the recipient of a diamond ring and complimentary address form the employees of the mechanical department of the London Street Railway Company. Mr Potter has been succeeded by Mr. Harry Welburn.

We regret to record the death of Mr. F. E. P. Pepler, barrister, of Barrie. The late Mr. Pepler was among the enterprising citizens who in the early days assisted to introduce the electric light, having been one of the largest stockholders in the local company. Deceased manifested distinguished abilities, not only in his chosen profession, but also as a business man and in political and municipal affairs. He was twice elected mayor of the town and filled many other responsible positions.

The following gentlemen from Canada attended the recent annual convention of the National Electric Light Association at Chicago: Mr. Fred. Nichols, manager Canadian General Electric Co., Toronto, who is an ex-president of the N.E.L.A.; Mr. W. McLea Walbank, manager of the Lachine Rapids Hydraulic & Land Co., Montreal; Mr. C. B. Hunt, manager London Electric Co., London, Ont.; Mr. A. A. Dion, superintendent Ottawa Electric Co. and president of the Canadian Electrical Association; Mr. E. D. McCormack, Canadian General Electric Co., Toronto; Mr. R. S. Kelsch, superintendent Lachine Rapids Hydraulic & Land Co., Montreal.

The Electrical Construction Co., of London, Limited, have recently received orders for four motors of different sizes from their Toronto agent.

The Noxon Company, of Ingersoll, have purchased from the Electrical Construction Co., of London, Limited, one 15 h. p. multipolar motor, and report being well pleased with the machine.

The Electrical Construction Co., of London, Limited, have completed a contract with the Chatham Navigation Co. for the wiring and complete installation of a 100 light electrical equipment for their boat at Chatham.

Mr. James F. Webb, of Ypsilanti, Mich., representing a syndicate of capitalists, is promoting an electric railway from Windsor to Ruthven and from Kingsville to Leamington, Ont. The capitalists are those who own the electric railway running from Ypsilanti to Orchard Lake, Mich.

The Smoke Nuisance and Big Fuel Bills

CAN BE GOT RID OF BY USING

THE REDPATH-REID AUTOMATIC SMOKE CONSUMER

THE Most perfect Fuel Economizer and Smoke Consumer in the World. Endorsed by the best master mechanics, engineers and coal users in the country. Every machine put on with a guarantee to consume 95% of smoke and a saving of from 10 to 20% in fuel. Can be used on any furnace. Patent rights for sale for Nova Scotia, Newfoundland, and a number of the States of the Union.

For further particulars apply to . . .

THE JUBILEE GRATE BAR CO., TORONTO, ONT.
FOOT OF WEST MARKET STREET

WATCH THIS SPACE NEXT MONTH

A. C.
SERIES
ENCLOSED ARC SYSTEM
MANHATTAN

Power Factor—
Complete Circuit Series
Lamps with Regulator—.00.

Manhattan Regulating Reactance Coil.
Regulator loss constant at all loads, 200 watts.
Regulators to provide for any percentage of circuit, from 10 to 100 per cent.

Manhattan Series A. C. Enclosed Lamps.
At 6.6 amp., 72-volts, 430 watts. Total loss in lamp, 5 watts.
Power Factor .91. Efficiency .00.
Terminal and Arc Voltage the same. Concentric mechanism, but one magnet used in lamp. No springs.

MANHATTAN GENERAL CONSTRUCTION CO., TORONTO, CAN. Office 409 Temple Bldg.

SPARKS.

A telephone line is being built from St. Martin's to St. John, N.B., the Bonny River Lumber Company being interested.

The Pontiac Telephone Co., of Pontiac, Que., was sold by the sheriff recently to Mr. William McCochon, for the sum of $1,700.

The St. Martin's Telephone Company, at annual meeting held at St. Martins, N.B., last month, elected John McLeod, M.P.P., president, W. H. Allan vice-president, and A. W. McMackin secretary.

Mr. E. H. Boss has resigned his position as local manager of the Bell Telephone Co. at St. Catharines, Ont., and has entered the employ of the Niagara, St. Catharines and Toronto Railway Company.

The Kinnear's Mills Telephone Co., of Kinnear's Mills, Que., are about to construct a telephone line from Thedford Mines to Kinnear's Mills, a distance of 12 miles, and have invited tenders for the work.

A recent report from Springhill, N.S., stated that owing to a disagreement between the town authorities and the electric light company as to the number of hours per night the light should burn, the contract had been cancelled and the town was in darkness.

The town of Dartmouth, N. S., made a proposition to the Dartmouth Electric Light Company to purchase their plant, at the price of $20,000. This the company refused to accept, and suggested $27,000 as the figure at which they would sell. It is probable that arbitration will be resorted to.

The electrical equipment of the D. S. Perrin Co., biscuit manufacturers of London, Ont., has gone through a great many radical changes since the company decided to operate their own plant. Originally a 125-light dynamo was thought to be sufficient for their requirements. This they found too small, but they retained it as a power generator to operate a 12 h.p. motor for running a box factory, and installed a 250 light dynamo to operate the lights throughout their factory. In the fall of 1899 they realized that they should have a larger lighting dynamo, but after receiving figures and making sundry tests they decided to retain the 250 light machine for another season, which they operated to over 250 lights regularly. They have now placed an order with the Electrical Construction Co., of London, Limited, for a 50 k.w. generator (67 h.p.), retaining the 250 light dynamo for operating their recently enlarged box factory. This makes four machines this enterprising firm of biscuit manufacturers have purchased from the Electrical Construction Co., of London, Limited, and they express themselves as well pleased with their operation.

The inauguration of the new electric street railway system at St. Johns, Newfoundland, took place on May 1st last. The road was built by Mr. R. G. Reid, of Montreal. The power house is situated at Petty Harbor, nine miles south of St. Johns. At this point a small river discharges its waters into the sea. The stream is fed from a chain of four lakes beyond the head of the valley, which run into each other. At the outlet of the last of these lakes Mr. Reid constructed a large dam, and from this a flume winds along a steep hillside for 3,300 feet, passing through a tunnel 350 feet in length, cut through the solid rock and terminating in a large sluice box of timber, at the bottom of which is a steel tube six feet in diameter, through which the water has a descent of 185 feet, to the bottom of the valley. The water wheel is 20 feet in diameter. The power house is 130 feet × 24 feet and is built of stone. The capacity of the plant is 3,200 h.p., although the present needs do not call for more than 2,350 horse power. The cars were built in Montreal. Mr. G. H. Massey, of Montreal, was superintending engineer, and Mr. W. Mackay electrical superintendent.

MOTOR TENDERS WANTED

Two good reliable men, with experience, to attend motors. Permanent position. Apply immediately, 74 Empress Crescent Toronto.

ENGINEERS, Firemen Machinists, and electricians: Send 10 cents for new 44 page pamphlet, containing list of questions asked by Examining Board of Engineers. GEORGE A. ZELLER, Bookseller, St. Louis, Mo., U.S.A. Mention CANADIAN ELECTRICAL NEWS.

FOR SALE

Owing to Enlarging Plant.

One 650 light 1000 volt Wood Alternator, Switchboard, Instruments Exciter and two spare Armatures, with 300 light capacity in transformers, for the sum of $600; can be seen working.

Also one 26½ inch Perfection and one 30½ inch Perfection water wheel, almost new, with shafting and crown gears and pinions, manufactured by Madison Williams, Port Perry, Ont., for the sum of $175 for the 26½ inch and $200 for 30½ inch wheel, which includes crown gears and pinions. These wheels can also be seen in operation. The whole or part of the above, along with some new 2½ inch shafting and pulleys, will be sold to suit purchaser. Full particulars may be had upon addressing a card to

THE BOWMANVILLE ELECTRIC LIGHT CO, L'T'D.,
Bowmanville, Ont.

FIRSTBROOK BROS.

King St. East, - TORONTO.

MANUFACTURERS OF
TOPPINS,
SIDE-BLOCKS
AND CROSS-ARMS.

WRITE FOR PARTICULARS.

FOR SALE

60 K.W. Westinghouse 1000 V. Alternating Generator, with Exciter; both in good condition.

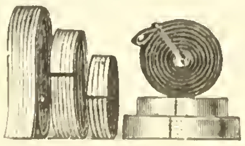
Electric Repair & Contracting Co.
617-619 Lagauchetiere Street MONTREAL

An' it's BELTS, BELTS, BELTS.—R. KIPLING.

F. E. DIXON & CO.

Oak Tanned

Leather Belting



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LONDON - ENGLAND
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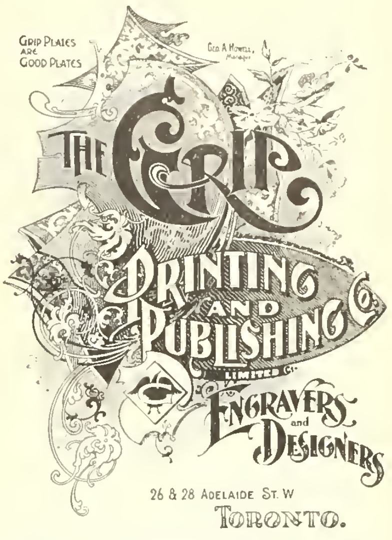
30 Wellington Street East, TORONTO, ONT.

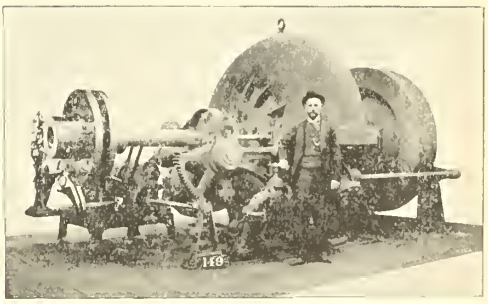
Send for Price Lists and Discounts.



VICTOR TURBINES

OPERATING DYNAMOS

That there are more **Victor Turbines** in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.



Features Worth Remembering

High Speed. Close Regulation, Great Capacity. High Efficiency, Perfect Cylinder Gate, Steady Motion.

RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Cataract Power Co., Hamilton, Ont.

CORRESPONDENCE SOLICITED

THE
Stillwell-Bierce & Smith-Vaile Co.
DAYTON, OHIO, U. S. A.

SPARKS.

The Central Electric Company, of Portage la Prairie, Man., will enlarge their plant this year.

The council of Parry Sound, Ont., are considering the question of taking over the electric light plant.

The town of Palmerston, Ont., will probably purchase the electric light plant now owned by Mr. C. Anderson.

G. C. Hinton & Company have secured the contract for electrical supplies for the corporation of Victoria, B.C.

Conroy Bros. have commenced the erection of a new power house at Deschenes, Que., to replace the one recently burned.

It is announced that by the early fall the Metropolitan Electric Company, of Ottawa, will have completed their power plant at Britannia.

A scheme is said to be on foot to erect a large power house at the Chaudiere, Ottawa, for the purpose of supplying electric power for industrial purposes.

Grand Forks, B. C., ratepayers are to vote on a by-law to raise $50,000 to complete and extend the water and electric light system and to make other improvements.

A committee has reported to the Montreal city council recommending that tenders be invited for operating an incline railway service to the mountain, to be operated by steam or electricity.

The owners of the Dufferin Mine, on Salmon River, in Nova Scotia, have recently installed an underground electric lighting plant, said to be the first of the kind employed in that province. The engine is 250 h.p. Corliss.

The Jacques Cartier Water Company, of Quebec, have purchased property on the corner of St. John and d'Anteuil streets, in that city, and are having plans prepared for a brick and stone building to be built thereon, to be used as office and distributing station.

Among the companies incorporated at the recent session of the Nova Scotia Legislature were the following: The Liverpool & Milton Tramway Co., of Liverpool; the Liverpool Marine Railway Company, and the Cape Breton Electric Tramway & Power Company.

The Toronto Railway Company will ask the York county council for the right to extend the Mimico and Lake Shore road to the Lorne Park rifle butts. The company purposes asking Peel county for the right to extend to Oakville.

Mr. Willis Chipman, C.E., of Toronto, has reported for the corporation of Brockville, Ont., on the valuation of the gas and electric light plants in that city. He places the value of the gas works at $56,000, and that of the electric light plant at $38,000. The value of the arc system was placed at $8,000. The corporation will probably take over the plants.

Chicago capitalists, including Messrs. D. S. Wegg, J. P. Wiborg, G. K. Clutton, W. H. Dayton and G. H. Pope, have been incorporated as the Auglo-American Power Company, with a capital of $5,000,000. The company is to acquire the Jenison water powers on the Kaministiquia river near Port Arthur, which it is the intention to develop for power purposes.

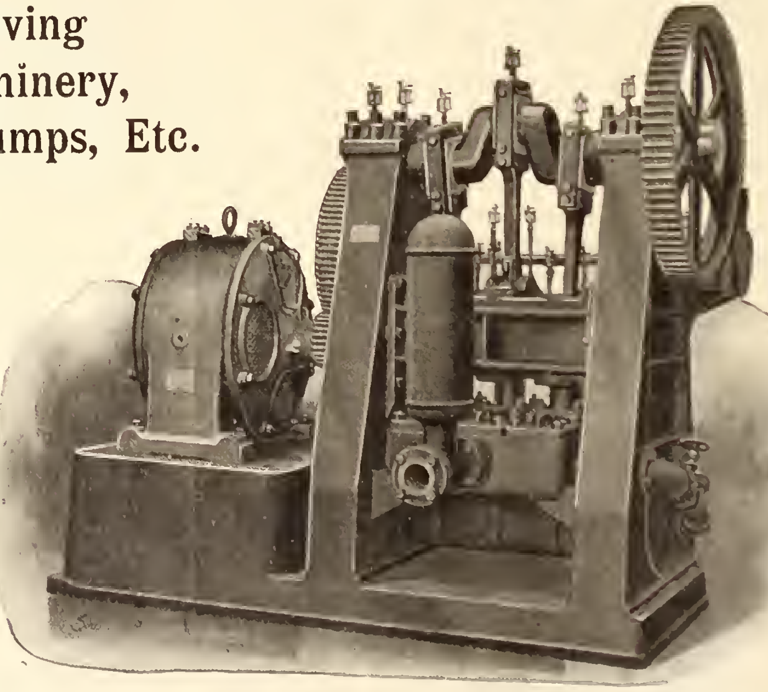
MOONLIGHT SCHEDULE FOR JUNE.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 9.30	A.M. 3.30	6.00
2....	" 10.00	" 3.30	5.30
3....	" 10.30	" 3.30	5.00
4....	" 11.00	" 3.30	4.30
5....	" 11.30	" 3.30	4.00
6....	A.M. 0.00	" 3.30	3.30
8....	" 0.20	" 3.30	3.10
9....	" 0.50	" 3.30	2.40
10....	" 1.20	" 3.30	2.10
11....	No Light.	No Light.	.... .
12....	No Light.	No Light.	.....
13....	No Light.	No Light.	.....
14....	No Light.	No Light.	.....
15....	P.M. 8.10	P.M. 10.40	2.30
16....	" 8.10	" 11.10	3.00
17 ...	" 8.10	" 11.50	3.40
18....	" 8.10	A.M. 0.20	4.10
19....	" 8.10	" 0.50	4.40
20....	" 8.10	" 1.20	5.10
21....	" 8.10	" 2.00	5.50
22....	" 8.10	" 2.40	6.30
23....	" 8.10	" 3.30	7.20
24....	" 8.10	" 3.30	7.20
25....	" 8.10	" 3.30	7.20
26....	" 8.10	" 3.30	7.20
27....	" 8.10	" 3.30	7.20
28....	" 8.10	" 3.30	7.20
29....	" 8.10	" 3.30	7.20
30....	" 8.30	" 3.30	7.00
		Total.........	130.20

WESTINGHOUSE
TYPE "C" INDUCTION MOTORS

For Driving Machinery, Pumps, Etc.

For Economy



AHEARN & SOPER - OTTAWA
AGENTS FOR CANADA

TRADE NOTES.

Messrs. Darling Bros., of Montreal, have placed on order with the Electrical Construction Co., of London, Limited, for two 5 h.p. bi-polar motors.

The Times Printing Co., of St. Thomas, Ont., have purchased from the Electrical Construction Co., of London, Limited, one 8 h.p. multipolar motor for operating printing presses.

The T. Eaton Co., Toronto, are making extensive changes in their electric plant, and have ordered two 350 horse power engines for direct connection to dynamos from the Robb Engineering Co.

The Electrical Construction Co., of London, Limited, recently received the following order from their agent in Winnipeg: One 1 h.p., two 2 h.p., one 5 h.p., and two 8 h.p. bi-polar motors, and two 15 h.p. multipolar motors.

The Electrical Construction Co., of London, Limited, report the following recent sales: Geo. May & Sons, Ottawa, one 5 h.p. motor; C. D. Burdick & Co., London, one 10 h.p. motor; The London Pant & Overall Co., one 6 h.p. motor; E. Parnell, London, one 8 h.p. motor; J. P. Archibald, Ingersoll, one 15 h.p. motor; Timbell & Co., London, one 3 h.p. motor; C. Kennedy, London, one 3 h.p. motor; H. W. Petrie, Toronto, one 12 h.p. motor; F. Raney, Kingston, one 8 h.p. motor; W. Carson, Kingston, one 3 h.p. motor; N. H. Good, Berlin, one 3 h.p. motor.

The United Electric Company, of Toronto, announce the following recent sales of apparatus: R. Anderson, Ottawa, one 30 h.p. motor, three 5 h.p. motors, two 12 h.p. motors, and one 2 h.p. motor; Chas. Morton, Montreal, three 2 h.p. motors; R. E. T. Pringle, Montreal, one 3 h.p. motor and one 8 h.p. motor; Miller Bros. & Toms, Montreal, four 5 h.p. motors, one 10 h.p. motor, and one direct connected elevator motor; John Turner & Son, Toronto, one 10 h.p. motor; Dominion Bridge Co., Montreal, one 60 k.w. generator; Maritime Electric Co., Halifax, N.S., one 10 k.w. direct connected generator; McBurney & Sons, Callander, Ont., one 20 light arc dynamo and lamps; Fred Thompson & Co., Montreal, one 5 h.p. motor and one 3 h.p. motor; S. F. McKinnon Co., Toronto, one 15 h.p. motor; Wm. McGill & Co., Toronto, one 10 h.p. motor; Canada Electric Co., Montreal, one 9 k.w. generator; West Lorne Electric Light Co., West Lorne, Ont., complete plant, both arc and incandescent, for lighting the town; Truth Publishing Co., Toronto, one 300 light dynamo; Darling Bros., Montreal, 5 elevator motors; Scott Bros., Ingersoll, Ont., one 10 h.p. motor; R. Elliott, Ingersoll, Ont., one 4 h.p. motor; P. Stewart & Co., Ingersoll, Ont., one 4 h.p. motor, C. S. Crabtree, Toronto, one 5 h.p. motor; A. Trudeau, Ottawa, one 5 h.p. motor; Paris Wincey Mills, Paris, Ont., one 500 light dynamo; C. N. Vroom, St. Stephen's, N.B., one 6 h.p. 500 volt motor; White Packing Co., Stratford, one 400 light dynamo and one 15 h.p. motor; A. Bauer & Co., Waterloo, Ont., one 35 light dynamo; P. W. Ellis & Co., Toronto, one 3 h.p. motor; C. W. Huffman, Winnipeg, one 6 h.p. motor; Perth Flax & Cordage Co., Stratford, one 100 light dynamo; Hodd Cullen Manufacturing Co., Stratford, one 50 light dynamo; Kootenay Railway & Navigation Co., Kaslo, B.C., one 10 k.w. direct connected generator; Rideau Lake & Navigation Co., Kingston, one 250 light generator; Lippert & Co., Berlin, Ont., one 100 light incandescent dynamo; John McGowan & Co., Alma, Ont., one 60 light dynamo; James Fenwick, Preston, Ont., one 70 light arc dynamo; Hamilton Steamboat Co., Hamilton, one 150 light dynamo.

SPARKS.

Tenders closed on May 30th for lighting the streets of Berlin, Ont., with 80 arc lights.

The village council of East Toronto have decided to again ask for tenders for a system of electric lighting.

The Paris Electric Light Company, Limited, of Paris, Ont., has been incorporated, with a capital of $20,000.

Mr. J. Carew, of Lindsay, Ont., has recently installed an electric light plant for lighting his saw mill and yards.

The Whitby Park and Electric Railway Company has been incorporated, to develop a summer resort scheme near Whitby, Ont.

Permission has been granted to the Sun Oil Refining Company, of Hamilton, to increase their capital stock from $15,000 to $50,000.

The promoters of the electric railway between Woodstock and Ingersoll, Ont., expect to commence the construction of the road in about a fortnight.

Mr. Jobin, an employee of the Quebec Lighting and Railway Co., was seriously burned at the Montmorency power house by coming in contact with a live wire.

The Citizens' Electric Light Company, of Smith's Falls, Ont., are increasing their plant. They will build a stone addition to the power house and put in another engine.

The city of St. John, N.B., has invited tenders for lighting the streets of the city by electricity. Tenders close June 29th. Mr. Robert Wisely is the director of the Department of Public Safety.

The Montreal Cotton Company have applied to the corporation of Valleyfield, Que., for a bonus of $50,000 and exemption from taxation for twenty years, in return for which they agree to considerably enlarge their works and to supply the town with light and power.

METERS

. . . MANUFACTURED BY THE . . .

SIEMENS & HALSKE ELECTRIC CO. OF AMERICA

To Officers and Managers of Central Stations:

The Duncan Integrating Wattmeters manufactured by the Siemens & Halske Electric Company of America are constructed after my design and under my personal supervision

The great facilities of this Company have enabled me to complete many improvements heretofore contemplated but never until to-day accomplished.

Thos Duncan

CANADIAN AGENTS

MUNDERLOH & CO. - MONTREAL

Write for Catalogue and Discounts.

SPARKS.

It is understood that negotiations are in progress with a view to installing an electric light plant at Port Maitland, Ont.

The by-law authorizing a bonus of $21,000 to the Port Dover, Brantford and Berlin Electric Railway Co. was carried in Berlin, Ont. a few days ago.

The time for receiving tenders for lighting the streets of Toronto by electricity and gas and for the supply of electric energy has been extended to June 15th.

The town of Toronto Junction, Ont., will issue debentures to cover the cost of installing an electric light plant. An expert has estimated the probable cost of a plant at $13,000

The Manhattan General Construction Company, of Newark, N. J., had the most extensive of the many arc light exhibits at the recent N. E. L. A. convention at Chicago. In the basement of the hotel this company had placed a 50 k.w. two-phase 1000 volt 60 cycle alternator, which was driven by a direct current motor. This alternator supplied two circuits of series alternating lamps, one of 12 lamps in a parlor occupied by the company's exhibit, and another of 10 lamps on the hotel's regular arc light standards in the street. The former circuit also contained incandescent lamps and instruments to show the constancy of the current obtained by the regulator when the arcs were cut in or short circuited. To connect up these circuits required 2,000 feet of lead covered wire. In addition to the two regulators in use on these two lines, the company showed a number of its standard sizes of the latest type, ranging in capacity from 12 to 100 lamps. The lamps shown in operation were of the latest type, with shunt regulating coils and no series coils whatever. The shunt coil is concentric with the carbon holder, and a dash pot, also concentric, is provided to prevent the shunt coil from striking the arc too suddenly, the dash pot cylinder being cut away so that over the normal range of operation, once the arc is formed, there is no retardation or friction. The cut-out is electro mechanical, the regulating magnet, in case it drops the clutch to its lowest limit, closing a by-pass around the arc, but through a magnet which holds the contact closed. With the shunt form of regulator used in this lamp, the power factor is improved over that of the series lamp, and, if desirable, the candle power of the lamps may be changed by simply varying the current, the arcs in this case remaining of constant voltage and not shutting up as they do in the differential form.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED THOMSON & CO.
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. Telephone Main 3149.

SADLER & HAWORTH

Manufacturers of

OAK-TANNED LEATHER BELTING

MONTREAL and TORONTO

Orders addressed to our Toronto or Montreal Factory will have prompt care.
Goods will be forwarded same day that order is received.

BELTS MADE SPECIALLY FOR ELECTRIC POWER USE.

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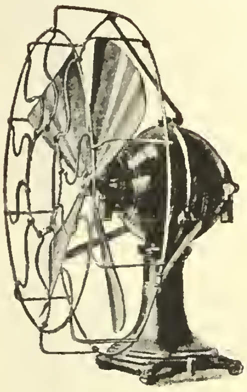
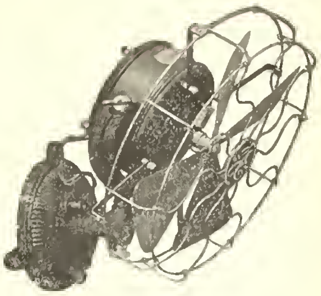
Volta Electric Storage Co.
Hamilton, Canada LIMITED

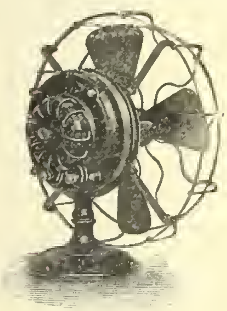
Canadian General Electric Company's

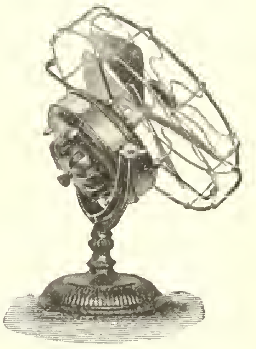
FAN MOTORS

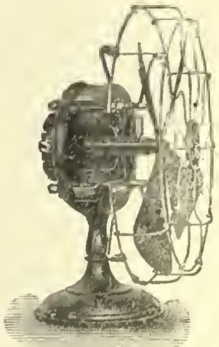
1900

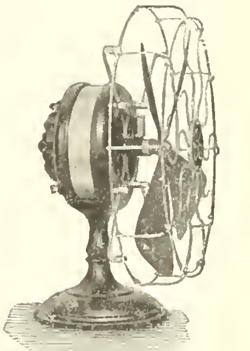












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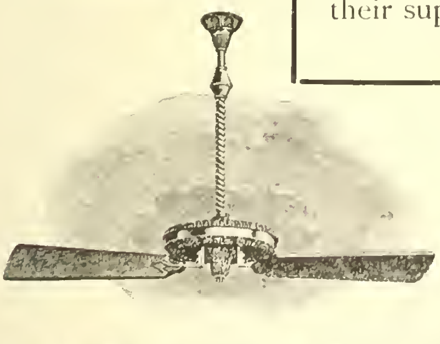

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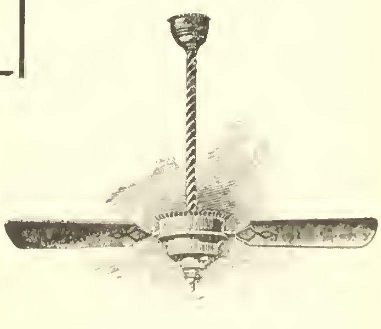

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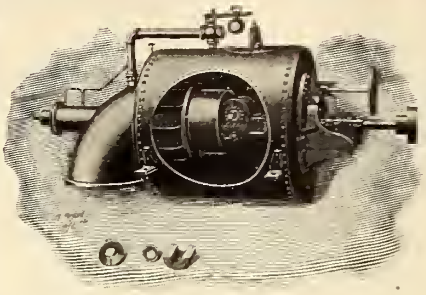

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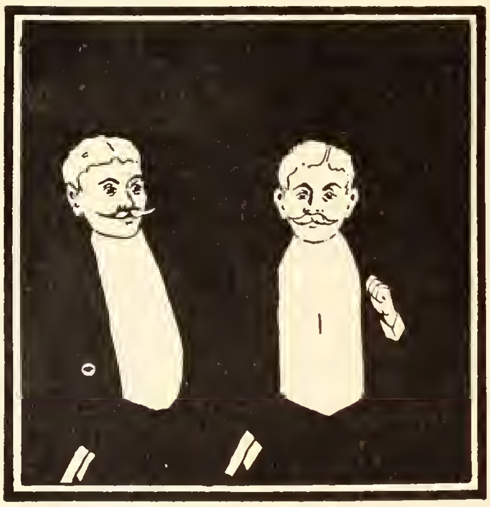

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Scientific American, Oct. 14, 1899.

The Automobile Magazine has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N Y. Evening Post, Oct. 9. 1899.

The new illustrated Automobile Magazine (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press; and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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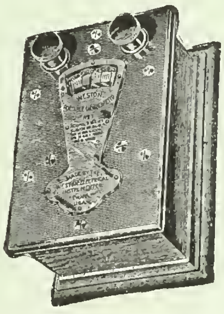

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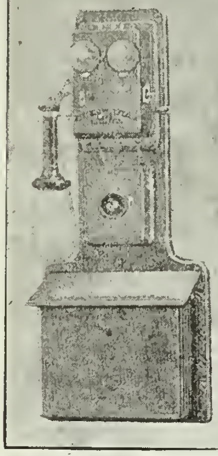

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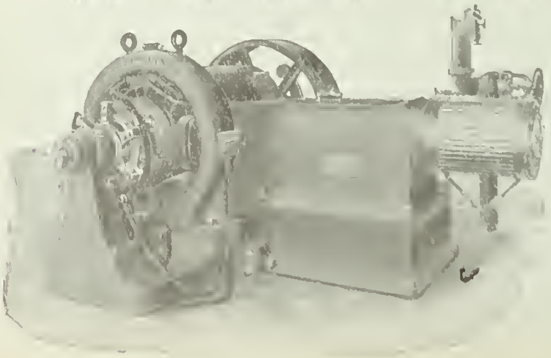

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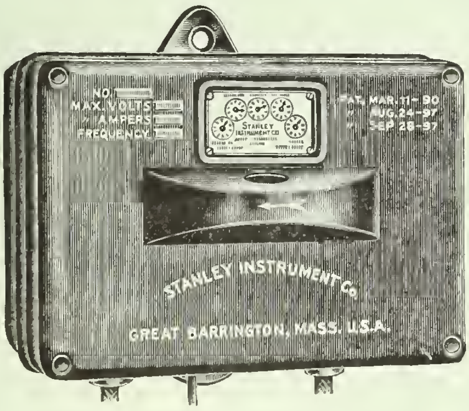

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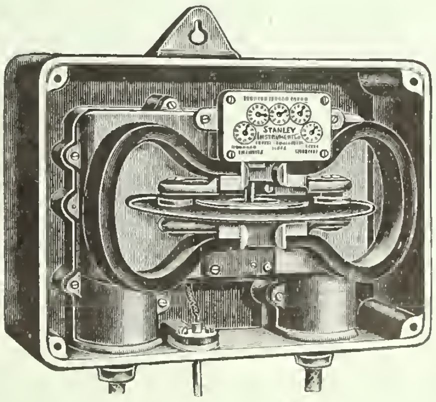

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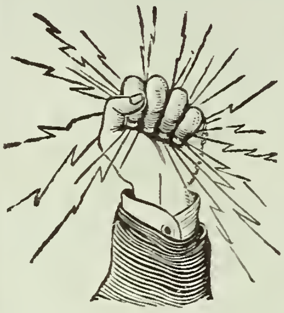

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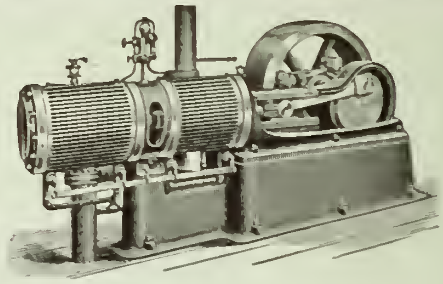

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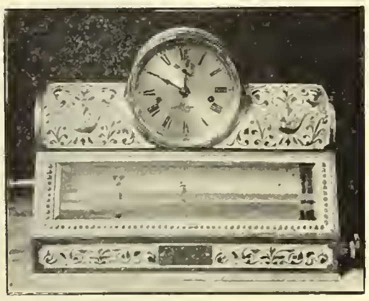

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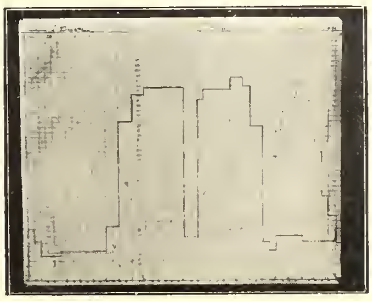

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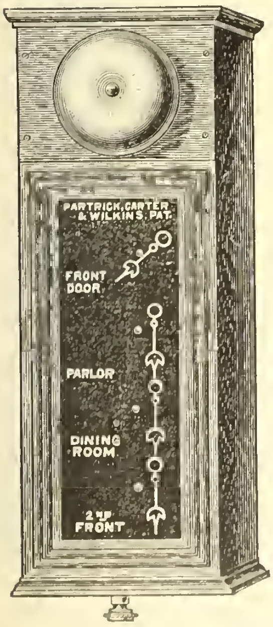

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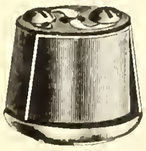

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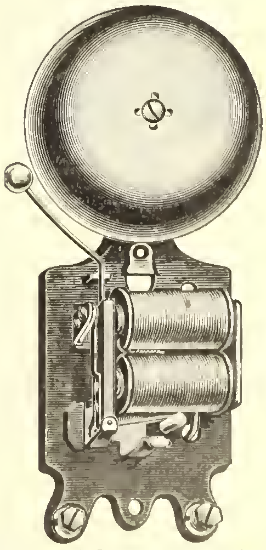

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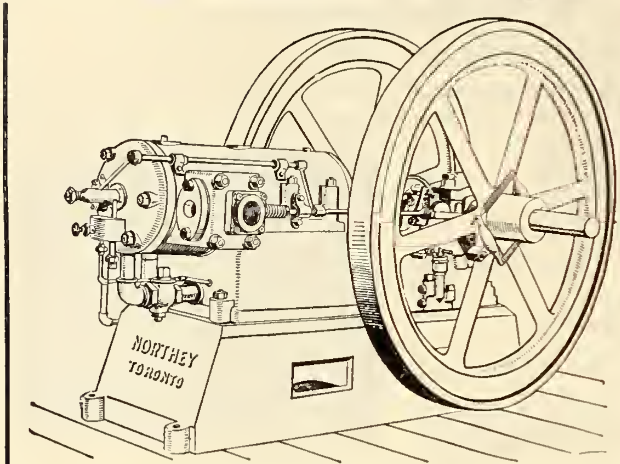

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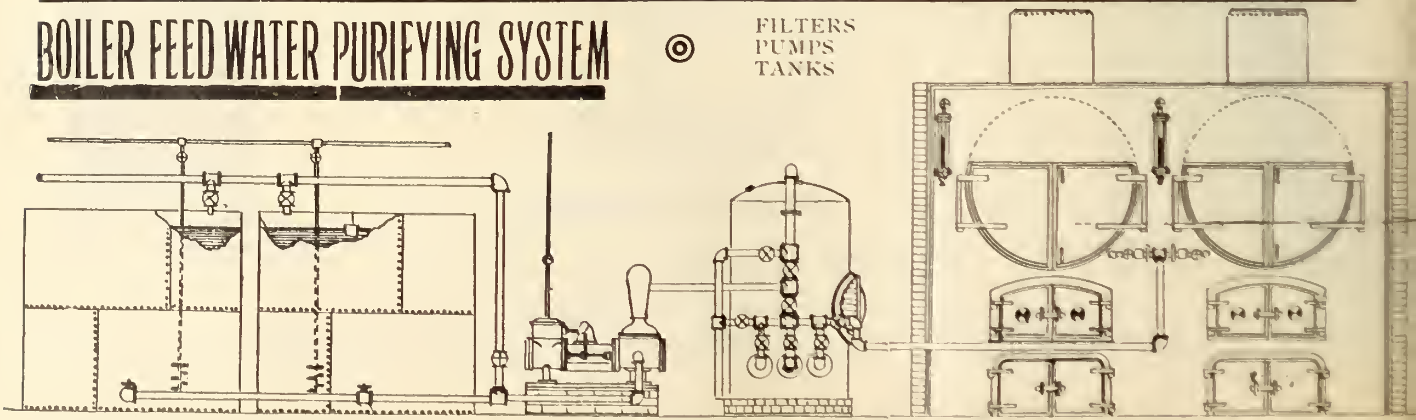

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VOL. X. JULY, 1900 NO. 7.

THE IMPERIAL ELECTRIC LIGHT COMPANY.

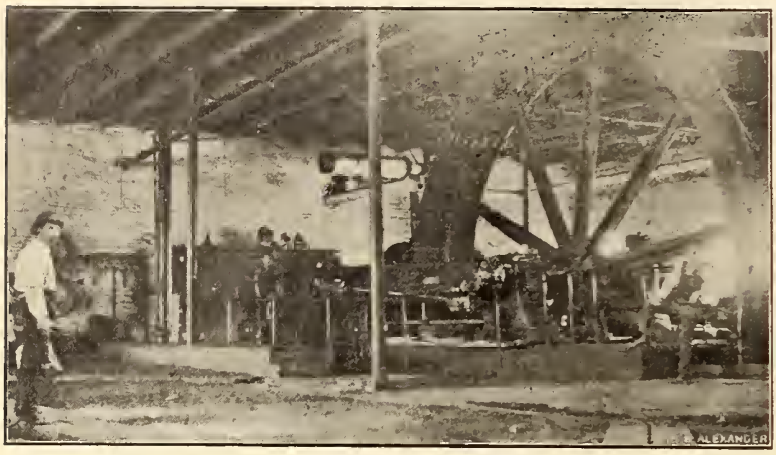
The origin of the Imperial Electric Light Company, of Montreal, dates from the spring of the year 1892, when Mr. Israel Charbonneau installed a small dynamo in his saw mill. He afterwards accepted Mr. Jos. E. Pare as a partner to assist him in promoting the business of electric lighting in St. Jean Baptist village, then a suburb of Montreal, but at present one of its most promising wards. Later these two gentlemen were joined by three others, Messrs. Jos. Girard, Damien Lalonde and Joseph Lalonde, and the business was extended towards the central part of the city. About the month of March, 1893, a company was organized to take over the assets and liabilities of the above mentioned co-partnership, and the St. Jean Baptiste Electric Company came into existence. On the first of June, 1896, the company was re-organized by the late Hon. Louis Tourville, and letters patent were granted on June 19th, 1896, incorporating "La Compagnie de Lumiere Electrique Imperiale," with a capital of $200,000. Messrs. J. M. Fortier, Arthur Caron, Hon. Louis Tourville, Onesime Marin, N. P., and Rodolphe Tourville were the provisional directors. Since that time some changes have occurred in the board from death and other causes, and the present directorate is comprised of Messrs. Victor Morin, N. P. president; Rodolphe Tourville, vice-president; E. J. Chapleau, treasurer; S. Z. Leboeuf and Dr. E. P. Chagnon, directors. The buildings as shown in Fig. 1, have a frontage of 184 feet and a depth of 94 feet, and are built of brick and stone. Previous to entering the works the attention of the visitor is directed to an inclined alley leading directly in front of the boilers, which is the means of dumping coal to the firemen, and which at the same time enables the company to keep an accurate record of the fuel used, by the employment of a Fairbank's scale. A portion of the space in this alley is occupied by a tank, 40 x 15 x 10 feet, of a capacity of nearly 30,000 gallons of water. This tank is kept well filled by means of an artesian well 235 feet deep. This well, the work of Mr. Wallace Bell, of Montreal, provides a very economical water supply. The Northey pump used in connection, has a capacity of 3000 gallons per hour, this supply of water being sufficient for steam and condensing purposes.

IMPERIAL ELECTRIC LIGHT CO.—VIEW OF BUILDINGS.

A chimney 134 feet high from the ground level, serves three Heine boilers, two of 250 h. p. and one 150 h. p., making a total capacity of 650 h. p. These boilers were built by the Geo. Brush Boiler Works, of Montreal. Two Worthington steam pumps are used to feed the boilers, and there is a heater also, to be used when running one of the high speed engines. In the engine room is found a Brown Cross Compound engine of 500 h.p., built with an attached direct-jet condenser. This engine was built by the Polson Iron Works Co., of Toronto, its fly wheel is 24⅓ feet in diameter, and its speed is 68 revolutions per minute. The driving shaft operates 320 revolutions per minute, and is connected to the fly wheel by a belt 46 inches wide and 131 feet long, which cost $1,400. To the left of the large engine is seen two small engines, one 135 h. p. Leonard Ball Compound, and the other a 80 h. p. Leonard automatic, the pulley of which travels at 300 revolutions per minute. The main shaft, which was made by Messrs. Miller Bros. & Toms, of Montreal, is connected to the above mentioned three engines, and to three dynamos, and is easily controlled by Hill's friction clutches.

IMPERIAL ELECTRIC LIGHT CO.—BOILER ROOM.

Two Westinghouse dynamos, 150 k. w., 2000 volts, ute, supply single phase current to a large number of 7200 alternations, operating at 730 revolutions per min-customers. There are two Westinghouse exciters attached to the dynamos ; these operate at 2150 revolutions per minute. There is also a third dynamo, with exciter of General Electric Company's make. A squeleton switchboard (Figure 5), containing all the required instruments, including three I. R. regulators made by the Canadian General Electric Company, Peterborough, provides the means of distributing the current, which is by a system of five circuits. A battery of four high voltage transformers serves to reduce from 5000 to 2400 volts the current supplied this company by the Lachine Rapids Hydraulic and Land Company. This set of transformers represents a total capacity of 1000 h.p., three-quarters of which is at present used by the company.

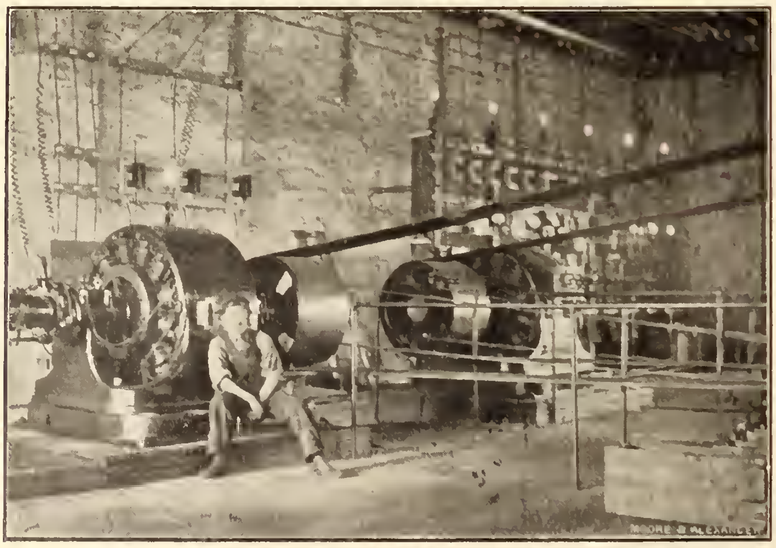


Imperial Electric Light Co.—500 h.p. Brown Cross Compound Engine.

There is an alarm gong, a complete tool and testing room, also the finest patrol service wagon in Montreal.

The Imperial Electric Light Company has entered into a contract with the Lachine Rapids Hydraulic and Land Company, by which it will be supplied with current by the latter company for the next eight years, and as means of precaution had their squeleton switchboard built to receive either Lachine Rapids water power current or steam power current. The business of the company is confined almost exclusively to stores, offices and places of business, the company having given no attention to the lighting of residences and public institutions.

The company is under the able management of Mr. Jules Bourbonniere, a portrait and sketch of whom appeared in our last issue, and whose portrait is reproduced on following page. Mr. Bourbonniere holds the dual position of manager and secretary. He is a great student and possesses a remarkable fondness for literature. In his residence will be found an up-to-date library and a scrap-book room of the contents of which he may justly feel proud. In the management of his plant he has a reliable assistant in Mr. Alfred Lepage, superintendent, whose portrait appears herewith.

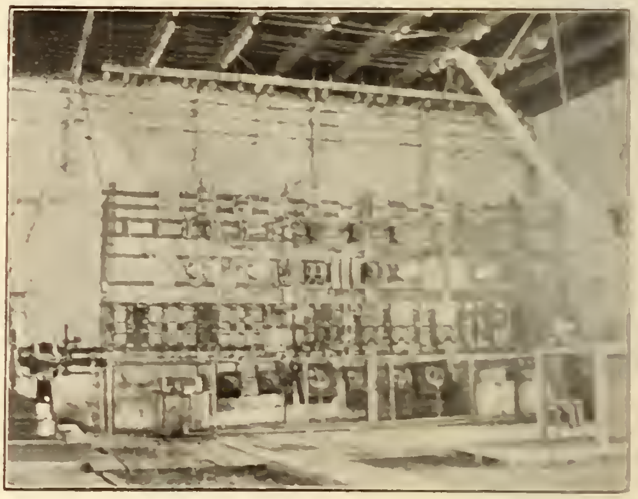


Imperial Electric Light Co.—Westinghouse Dynamos and Distributing Switchboard.

The company own several tenement houses adjacent to their works, these being occupied by employees.

TREATMENT OF DRIVING BELTS.

The Werkmeister Zeitung gives directions on the best treatment of driving belts, whose faultless working is of great importance in every factory. The good drawing of a belt increases with the friction between belt and pulley. Hence it is obvious that the belt must surround as large a portion of the pulley as possible. For this reason crossed belts always pull better than open ones. If in any way practicable, open belts should cover at least almost half the pulley. If the circumference of one pulley be very small in proportion to the other, thus allowing the belt to cover only a small portion of the smaller pulley, a sliding of the belt frequently takes place, especially if the distance between the two pulleys be slight.



Imperial Electric Light Co.—Switchboard.

It is plain, continues the Werkmeister Zietung, that a slow running of the engine makes a strong stretching of the belts necessary. For this reason a tightening-pulley is frequently placed midway between the two pulleys, so as to avoid a repeated resewing.

If a large power is to be transmitted at little velocity, a broader belt should be employed than would be necessary with greater velocity, or else two belts are made to run on top of each other. If one does not care to tighten the belts still more or use one of the many belt lubricants, the best makeshift is to cover the pulley with sail cloth. This is done by cutting the sail cloth so exactly that it is difficult to get it on the pulley. By thoroughly moistening the sail cloth on the pulley with warm water it clings more closely to the pulley, as the water causes it to shrink. It is still more practical in the long run to fix, instead of canvas, a leather strip of corresponding breadth on the middle of the pulley, by having a few holes bored into the rim of the pulley which are tightly filled up with wooden wedges, in order to be able to nail the strip of leather on it. This process is said to have proved useful with ordinary proportion of the size of the belt to the effect of power to be transmitted. If all is unavailing, the belt is too weak and must be replaced by a broader or double belt. Of great advantage in cases are the wooden belt pulleys, which increase the driving power.

Mr. Jules Bourbonniere,
Manager Imperial Electric Light Company.

STANDARD RULES.

The committee on standard rules submitted the following report at the recent convention of the National Electric Light Association :—

"Your committee has continued the same line of policy during the past year as heretofore, viz., to discountenance any changes in the National Code of Rules not absolutely necessary ; but with the march of improvement in the electrical field some changes therein and additions thereto have been found necessary since the issue of 1897. Many of the changes made were suggested by the chairman of your commitee, and others received his approval. The policy heretofore pursued by the insurance organizations of sweeping out of existence thousands of dollars' worth of material that had been used previously with the sanction of insurance inspectors has been abandoned, and, while new and better devices and material are substituted, an opportunity is offered the manufacturer, dealer, contractor and station manager to sell and use the material and fixtures on their hands.

"The thickness of interior conduit, lined or unlined, has been established, and commercial gas-pipe taken as the standard.

"'Weatherproof' wire, so called, is tabooed for interior construction unless covered with a slow-burning material.

"A standard of thickness of insulation on wire, after a conference with the manufacturers, has been established.

"The much-vexed question of the proper distance between fuse terminals has been determined, as well as the distance between fuse metals of opposite polarity. Switches are now being standardized as to the proper breaking distance between poles, etc.

"The rules have been changed so as to permit the running of two more small motors in series multiple or multiple on constant-potential circuits.

"Rubber insulation is not now insisted on for flexible-cord pendants in dry places, but an elastic slow-burning material may be used.

Rule 40 has been so amended as to permit in dry places the use of a slow-burning insulation similar to what has been known in the past as 'Underwriters.'"

ACCIDENTS TO STEAM BOILERS IN FRANCE.

The British Institute of Civil Engineers gives, in Foreign Abstracts, an interesting tabulated resume, taken from the official reports, of the whole of the accidents occurring to steam boilers in France during the year 1896. The information given comprises the date and situation of the accident, details of each boiler, the circumstances attending the accident, and the consequences and presumed cause of each accident.

In 18 cases defective design and workmanship was the cause of the accident, the principal defects being—1, parts made inaccessible to complete inspection ; 2, tubes of too large diameter and too thin ; 3, copper fire-box above the level of the water, and unprovided with safety appliances ; 4, copper of too thin a gauge ; 5, fire-door opening too weak; 6, supply pipes not provided with expansion joints ; 7, staybolts badly made ; 8, cast iron parts of bad design or subject to unequal expansion ; 9, plates of two low a grade for the strains to which they were submitted.

Defective maintenance was the cause of 14 accidents through—1, corrosion of plates and other parts ; 2, wear and deterioration of brass smoke-tubes ; 3, wear and defective repair of a copper fire-box ; 4, over-straining of a staybolt ; 5, defective making of joints.

Careless working caused 15 accidents, viz., in five cases through shortness of water, and in seven cases through want of cleaning ; in one case through an excess of pressure, and in two cases through tightening joints while under steam. In five cases the causes of the explosion were not ascertained.

Mr. Alfred Lepage,
Superintendent Imperial Electric Light Company.

Further tables classify the accidents according to—1, the class of work for which the boiler was employed ; 2, the type of boiler ; 3, the presumed cause of the accident. The total number of accidents dealt with was 44, which resulted in injuries to 25 men and death to 16.

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Correspondence is invited upon all topics legitimately coming witbin the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Cost of Fuel. THE recent increase in the price of soft coal with the consequent proportionate increase in the import duty, has proved a serious item in the expense account of large power users. The Toronto Electric Light Company, who burn something like 60,000 tons of coal per annum, propose to avoid this serious extra expense by importing in their own vessels direct from the mines a species of hard coal or culm, which, when burned with a proportion of soft coal, gives results almost equal to those to be obtained by using soft coal alone. This fuel, besides being cheaper in price, is not subject to the import duty of 25 cents per ton, which of itself is a substantial item.

Recording Wattmeters on Switchboards. IN a paper presented to the North-Western Electrical Association on June 26th, Mr. W. Worth Bean points out the advantages of using recording wattmeters on switchboards. These may be briefly stated thus: 1. Knowing the actual output of his station, the manager can intelligently purchase and test the quality of his fuel. 2. A check is afforded upon the work of the fireman, whose carelessness or inefficiency cannot be laid to the poor quality of the fuel. 3. The given amount of current leaving the switchboard being known, it becomes possible for the station manager to tell if his current is wasted in motors, transformers, lamps or wire connections.

The Dodge Telephone Company. A PARAGRAPH which recently appeared in the daily press stating that a protest had been received by the City Council from Mr. J. A. McMurtry, representing the Dodge Telephone Company, against the renewal of the agreement with the Bell Telephone Company, served as a reminder to the public that the plans of the Dodge Company for the supply of a cheap and efficient telephone service to the citizens of Toronto appear to be materializing very slowly. Mr. McMurtry, in his communication to the Council, states that he will soon be in a position to make a proposition to the city. In common with other citizens we await the early fulfilment of this promise. If the Dodge telephone system is all that its promoters claim it to be its appearance will be welcomed in a more tangible form than it has yet assumed.

Gas Engine Tests. IN view of the rapid development of iron production works in Canada, interest attaches to recent tests in Belgium of a gas engine of the Delaware-Deboutteville type, supplied with gas directly from the blast furnaces. The engine was specially designed to operate in this manner, the cylinder being unaffected by the residuum of dust in the gas after it had been cleansed by being passed through depositing chambrse. Specimens of the gas taken from time to time were submitted to calorimetric test. The speed of the engine during first test varied from 92.48 to 94 r.p.m., and the number of admissions was exactly half the revolutions. Calculation showed that the thermal efficiency was 27.11 per cent.; that is, this figure represented the ratio between the heat turned into work and the heat available for work. The net efficiency or the ratio between the work a[illegible]e brake and that of the heat in the gas consumed varied from 19.86 to 22 per cent., a figure much higher than it is possible to obtain with the steam engine. At full load the thermal efficiency was between 25.25 and 27.16 per cent., and the net efficiency between 20.44 and 22 per cent. The mechanical efficiency of the machine was 73 per cent. at half load and 81 per cent. at full load. On the second test, the thermal efficiency was 27.34 and 27.10 and the net efficiency 20.60 and 22.17 per cent. of the total heat supplied 20 per cent. was converted into work, 52 per cent. passed away in circulating water, and 20 per cent. in the exhaust. The consumption of gas varied from 31.13 cubic meters to 31-56 cubic meters per horse-power hour.

Popularity of Horseless Vehicles. THE constantly increasing number of automobiles and locomobiles to be seen on the streets of Toronto may we presume be taken as tangible evidence of the growing popularity of horseless vehicles. The opening out of two large showrooms on the principal thoroughfares also witnesses to the oncoming of the horseless age. Still another indication in this direction is the adoption by the post office department of automobiles for the delivery and collection of mail matter from the trains and branch post offices to the general post office. Electricity, gasoline and steam are all in evidence as the propelling power for these vehicles, and it remains to be seen which method will ultimately gain the ascendency. It will probably be found that each has advantages for particular duties and circumstances.

The Canadian Exhibit at the Imperial Institute. The resources of Canada, and particularly of the province of Ontario, are by no means properly or creditably represented by the exhibit at the Imperial Institute in London. The visitor would be much more favorably impressed if the exhibits of the various provinces were placed side by side, instead of on different floors. The present arrangement does not convey the idea that Canada is one Dominion, but rather that it consists of a number of separate provinces having little or no connection with one another. The exhibit should be arranged in compact form like that of Australia. As to the character of the exhibit, and more particularly that of the province of Ontario, the richest and most important of of the provinces, there is good ground for complaint. One would suppose from the numerous views of Niagara Falls placed about the walls, that this great natural phenomenon was the one distinguishing characteristic of the province of Ontario, while the specimens of Indian work are well calculated to confirm the idea, already to prevalent in the minds of some of the people of Great Britain, that Canada is a wild and uncivilized country. Ontario is known on this side of the Atlantic as a fruit-growing province, and the quality of its production in this line is not excelled by those of any other country. In view of this fact, it is extremely humiliating to a Canadian to observe that the jars containing samples of Canadian fruit shown in this exhibit have apparently not been refilled during the last decade. What was once fruit might now, judging from appearance, be almost any other substance under the sun. There is also displayed a view of the Toronto Industrial Exhibition of date the year 1885, which, of course, conveys a totally inadequate idea of the character and extent of the Exhibition of to-day. We would suggest that all relics such as this and the photograph of the ruins of Fort Erie, might well be thrown out of the exhibit, and modern views of our principal cities and industries substituted, so that visitors would be given an approximately fair idea of the kind of country Canada is, the extent of its development, and its advantages as a place of residence and business enterprise. The Canadian Pacific Railway show some excellent views of harvesting in Manitoba. These are well calculated to make a favorable impression upon intending emigrants. There is also an excellent geological map of Ontario containing a large amount of information with regard to the population and resources of the province. There is a fairly good exhibit of building stones and marbles, also of hardwoods. Other features equally valuable might be added, so as to convey to visitors a proper idea of the country and its resources. The entire exhibit should either be rearranged, improved, and brought up-to-date, or entirely done away with.

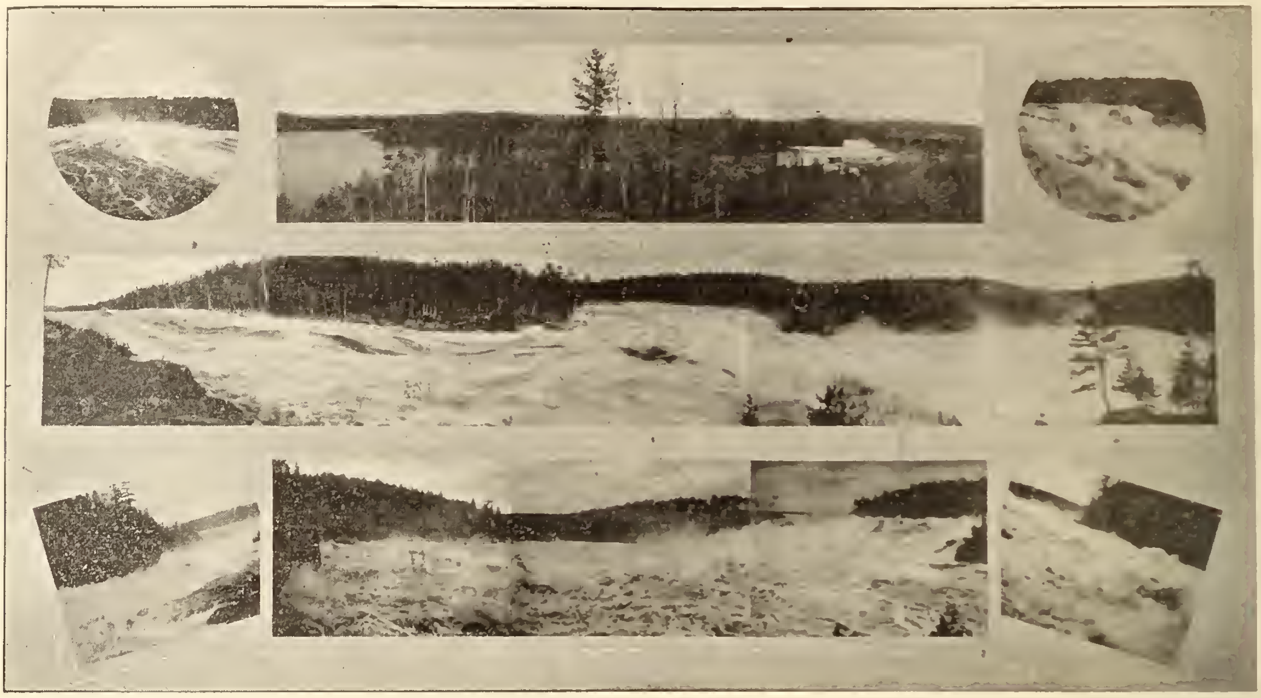
The Proposed Dominion Exhibition. THE Executive of the Canadian Manufacturers' Association have been considering the question of the advisability of holding a Dominion Exhibition in Toronto next year. The opinion of the members of the Association has been asked as to whether the Association should go beyond this and make an exhibit at the Pan-American exhibition to be held in Buffalo. The consensus of opinion seems to be that, if the project for a Dominion Exhibition is gone on with, no attempt should be made to exhibit at Buffalo. This opinion seems well founded. If a Dominion exhibition is undertaken and carried out on a creditable scale, it will sufficiently tax the energies of the Association. It must also be borne in mind that the possibility of finding a market in the United States for Canadian manufactures is extremely small, seeing that the United have now an over-production in almost all lines of manufacture, and are looking for outlets in foreign markets for their surplus goods. We have felt for several years past that the holding of an Exhibition in Toronto, on such a scale as to attract visitors from all parts of the Dominion should be productive of much good, and if the attempt is to be made it might as well be next year as any other time. The Exhibition at Buffalo would not be likely to interfere with its success, but on the contrary might add to it, as some of the visitors to the larger exhibition might be disposed to visit Toronto also. Speaking generally, it would seem as though the Exhibition idea is likely to be carried to an extent which will eventually deprive it of any novelty or usefulness. We observe that on the heels of the Buffalo Exhibition is to come another one at St. Louis, preparations for which are already in progress. There is also to be one held next year in Glasgow. If Canada is to have an Exhibition on a national scale, it would be as well to launch the enterprise at once, so that we may not come in at the tail of the procession.

At the last regular meeting of the Engineers' Club of Toronto, a discussion took place, led by Mr. James McDougall, C. E., on "Freight Traffic on City and Suburban Tramways."

The only tender received by the city of Toronto for electric lighting was that of the present contractors, the Toronto Electric Light Company. The company offer, in the event of the present contract being renewed for five years, to provide the service at $71.90 per lamp, per year, and for a ten years' contract at $65.70 per lamp, per year, using enclosed arc lamps. A tender was also submitted by the Kitson Incandescent Company for the Kitson incandescent light at $90 per year. The council have employed Mr. G. R. Rosebrugh, of the Electrical Department of the School of Practical Science, to test and report upon the comparative illuminating power of the Kitson light as compared with that of the electric lamps now in use.

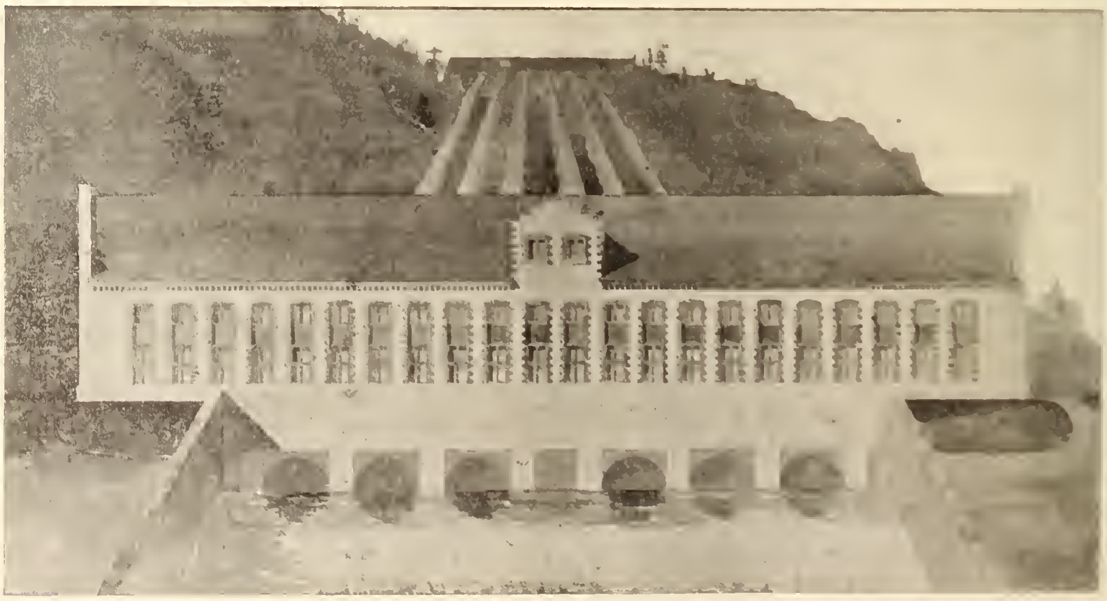
THE SHAWINIGAN WATER AND POWER COMPANY.

The following description of the extent of the proposed operations of the above company and of the hydraulic work in connection with the extensive plant which they propose to install at Shawinigan Falls, is abstracted from a recent issue of the Engineering Record. At a later date particulars will also be given of the electrical plant.



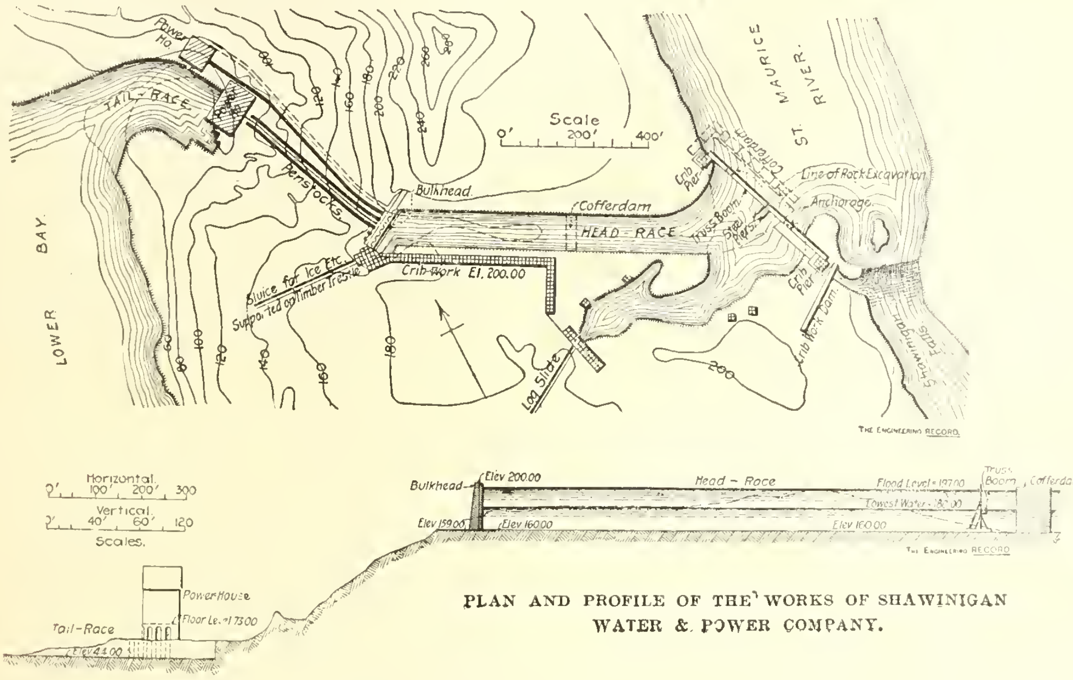
VIEW OF THE SHAWINIGAN FALLS.

The St. Maurice River is a stream draining 18,000 square miles of heavily timbered country on the north side of the St. Lawrence River, into which it empties at the city of Three Rivers, situated about half-way between Quebec and Montreal, the distance to either of these cities being 90 miles. About 15 miles back from the St. Lawrence, this river, in breaking through the Laurentian hills, forms in a distance of 15 miles a number of falls and rapids, which with the heavy flow of water obtainable, are capable of development into power at a very low capital cost. A minimum of 200,000 horse-power can be developed here at the lowest known water, even after allowing a liberal proportion of the flow for the carrying away of frazil or anchor ice during the winter. As the low water in this region unfortunately occurs in the winter some allowance of this kind has to be made. Owing to the lack of railroad communication, these desirable properties have lain fallow, but the opening of the Great Northern Railway of Canada, which will give the best of them direct communication with Quebec, Montreal and Ottawa, and thus open them to the world, has made their commercial development feasible. The city of Three Rivers is open to ocean navigation for eight months in the year, and it is not improbable that at no other seaport in the world is there a power of such magnitude within a radius of 30 miles. A portion of this power has already been developed at Grand Mere, distant 30 miles from Three Rivers, where it is utilized under a head of 40 feet in the operation of a pulp and paper mill, having a capacity of 100 tons of paper and 50 tons of pulp daily.

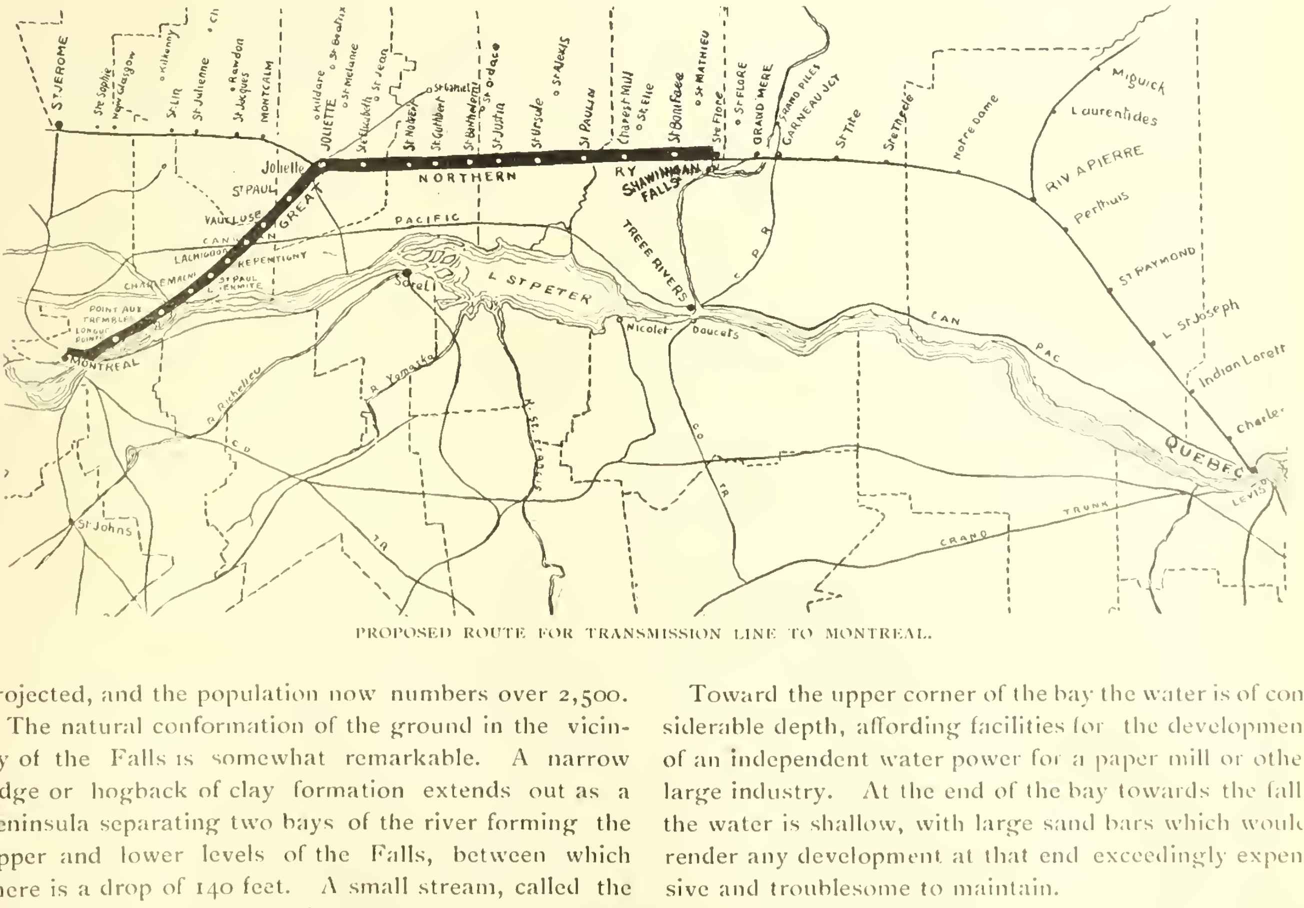


VIEW OF THE POWER HOUSE.

The most important power location, however, is that at Shawinigan Falls, a cascade having a fall of 140 feet in a very short distance. The normal flow of the river at this point is 24,000 cubic feet per second, and 100,000 horse-power can be developed and utilized at the very lowest water. The Shawinigan Water & Power Company has acquired the whole of this power from the Government, and is developing it on a large scale. It has acquired large tracts of land in the vicinity, built a standard guage branch 4½ miles long through rough country to the Great Northern Railway, with sidings, turntable and terminal facilities, and has been working throughout the past winter on an initial development of 30,000 horse-power with a head-race and intake of sufficient capacity for extension to 60,000 horse-power. A town site has been laid out, and its improvements projected, and the population now numbers over 2,500.



PLAN AND PROFILE OF THE WORKS OF SHAWINIGAN WATER & POWER COMPANY.



PROPOSED ROUTE FOR TRANSMISSION LINE TO MONTREAL.

The natural conformation of the ground in the vicinity of the Falls is somewhat remarkable. A narrow ridge or hogback of clay formation extends out as a peninsula separating two bays of the river forming the upper and lower levels of the Falls, between which there is a drop of 140 feet. A small stream, called the Shawinigan River, falling into the lower bay, carries this peninsula still further back, making it nearly a mile in length, with a width from 600 to 1,000 feet. This ridge, along which the railway is carried, was originally only 5 or 6 feet wide on top in places, falling away with slopes of 1½ to 1 on each side, and although formed of nothing but blue clay has withstood the pressure of water coming within 20 feet of the crest at high whter, the distance through the section of the ridge from water to air being not over 60 feet. Borings taken for a depth of 80 feet below water during the past winter show nothing but blue clay. This bank was, however, being carried away slowly by erosion, and must at some future date have broken through. After building the railway along the ridge the bank has been thoroughly rip-rapped with loose stone from the excavation in the head-race, thus obviating all danger of this kind.

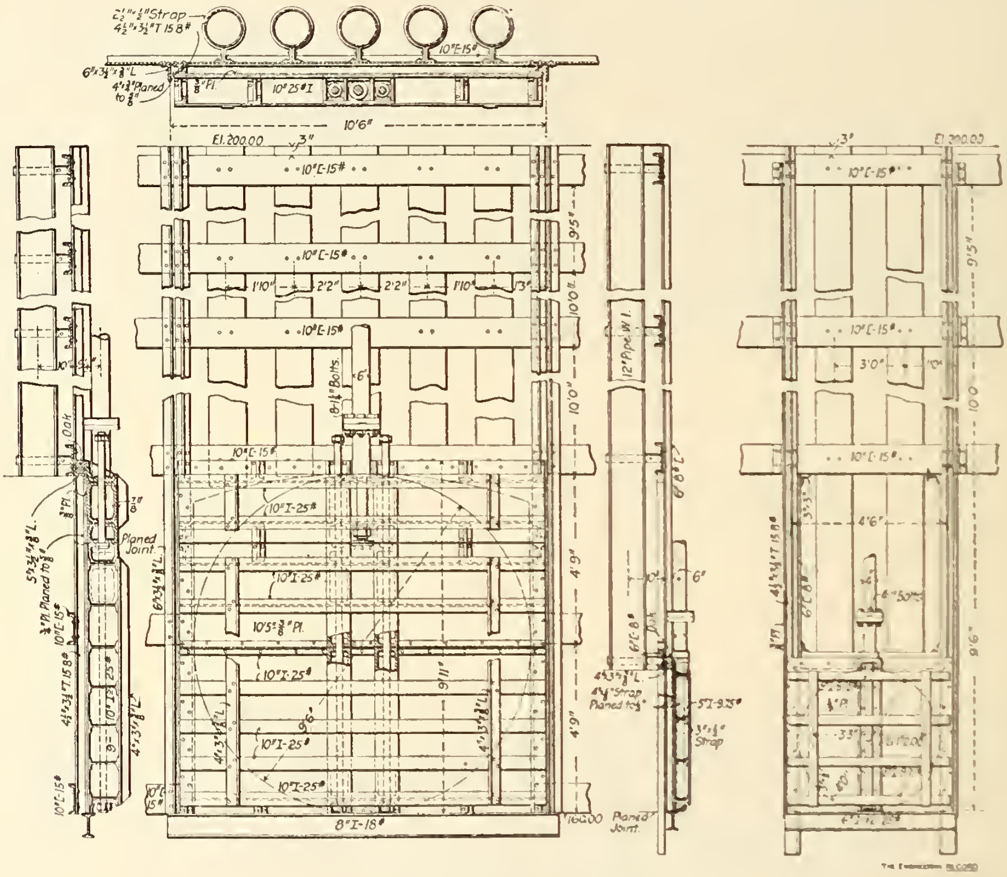
Toward the upper corner of the bay the water is of considerable depth, affording facilities for the development of an independent water power for a paper mill or other large industry. At the end of the bay towards the falls the water is shallow, with large sand bars which would render any development at that end exceedingly expensive and troublesome to maintain.

Just above the Falls the river is divided, by a large island, into two channels, both of which converge half way down the Falls. The united waters strike directly into the face of a rock cliff and turn at an angle of about 110 degrees to their course, forcing their way through a narrow gorge, in which there is a drop of 25 feet, into the lower bay.

The present development consists of an intake canal or head-race about 1,200 feet long cut through rock from a point just at the head of the Falls and running back at an angle of 135 degrees with the course of the river, with a glance boom to deflect floating debris and ice over the Falls, terminating with a heavy masonry bulkhead from which the water is carried in large steel penstocks to the power-house below.

This canal is funnel shaped for about 500 feet of its length at the entrance and beyond this has a width of 100 feet by a depth sufficient to give 20 feet of water at the lowest known level.

The sides are formed by the natural rock, above which they are carried up to a height of 40 feet by a dry-stone wall on the right hand side, on which the natural ground is high, and by a timber crib-work wing dam on the left hand side. The dry wall is built of heavy stone with vertical stepped back, the face being battered 2 inches to a foot. This wall is from 6 to 20 feet high, and is filled in behind with loose stone and gravel as as to form a road along the bank of the head-race.



GATE AT HEAD OF PENSTOCK.

The cribwork dam, 15 feet and 20 feet wide and from 10 to 23 feet high, is built of 12 x 12-inch pine face timbers, laid 2 inches apart, with 10-inch round pine cross-ties 10 feet apart in each course and staggered in alternate courses so as to form 5-foot pockets, and with 6-inch flattening longtitudinal stringers running through the center. This dam is faced with two layers of dressed pine plank, 2 inches thick. Both the face timbers and sheetings are closely scribed to the rock, and the dovetailing of the ties into the face timbers and general fitting is of a superior character. The crib is filled with stone very closely packed and is backed with stone for about half its height. A talus of gravel is to be laid along the outstream side extending over to the edge of the excavation. All bolting was done with ⅞-inch round spikes driven into ¾-inch holes, bored by a pneumatic boring machine.

At the end of this crib, next the bulkhead, is placed an ice chute to carry off drift ice and trash from the racks, and the crib being 40 feet high at this point, is 30 feet wide. Cribwork was used along this side of the canal so as to be easily removed when the canal is widened and the bulkhead extended for additional penstocks required to develop 60,000 horse-power.

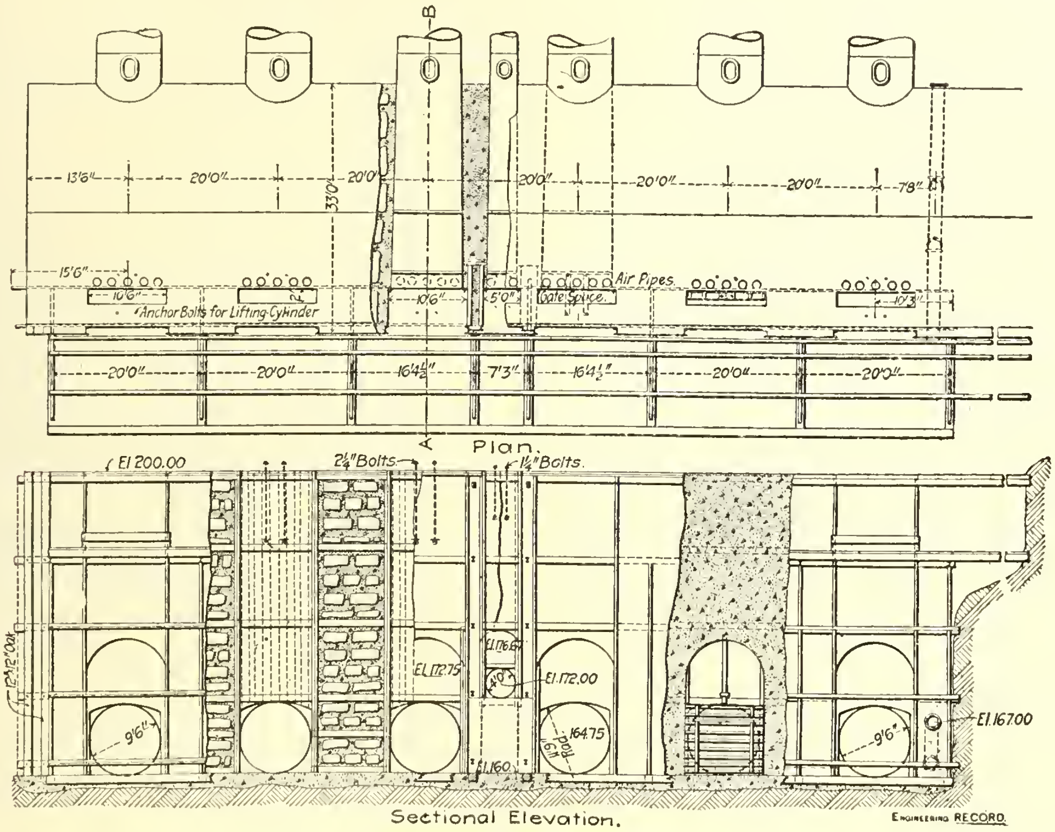
The entrance to the head-race is protected by a heavy glance boom in two sections, each 220 feet long, supported by two heavy crib piers at the ends and by a steel structure at the center. The cribwork piers are 30 x 30 feet square by 26 feet high, and are built of 12 x 12-inch pine face timbers, laid to 2-inch spaces, with 6-inch flattened cross-ties 10 feet apart in each course, staggered in alternate courses. They are faced with 6-inch oak on the outstream and upstream sides, and each of them has two elm mooring posts 20 inches in diameter, capped with cast iron. The bottom timbers are bolted down with 24 fox-bolts 1½ inches in diameter running 5 feet into the rock.

The steel bottom pier consists of a bent of two vertical posts, each made of a pair of 15-inch channels 38 feet two inches long. These uprights are 22 feet apart in the line of the boom, and are braced with horizontal and diagonal struts, and sway bracing in every direction, particularly, of course, in the direction of pressure at right angles to the line of the boom, the connections being made with gusset plates riveted between the webs of the channels. The bases of the bents are each formed by two pairs of angles set up on concrete piers. These bases are anchored down with 1½-inch fox-bolts 10 feet long, running 6 feet into the rock and having a cross piece to set into the concrete base piers. Half-round rubbing pieces are provided to allow the boom to slide smoothly up and down, and heavy shackles are provided to which the boom chains will be secured.

The boom is made in the form of a Howe truss, there being two sections each 220 feet long, 4 feet deep and 10 feet wide. The face timbers are three courses of 12 x 12-inch timbers with 3-inch plank laid solid between, diagonally, forming the main bracing, the counter-bracing being formed by 4 x 12-inch timbers on edge spiked to the main bracing. The truss is divided into 10-foot panels and bolted with iron bolts 1¼ inches to 1¾ inches in diameter with plate washers. On the outstream side the boom is faced with 3-inch tamarack plank laid longitudinally to take up the wear of the ice, etc.

Heavy ring bolts are provided for securing the boom to the mooring posts. The main anchorage for the boom, however, will be 1½-inch steel chains secured to heavy ring bolts bedded in concrete in the river bottom. These are placed so that the boom will engage the boom piers at all heights of water and have a tendency to keep toward the piers. The chains secured from the ring bolts to the piers give double safety against the possibility of losing the boom.

The bulkhead is to be built of what may be called concrete rubble. The bottom under the bulkhead is solid rock, and on this will first be laid a footing of 1:2:5 concrete extending 25 feet in front of the bulkhead. On this the steel rack framing, gate slides, pipes, etc., will be set up, and the concrete bulkhead will then be placed. This is 32 feet wide on the bottom by 15 feet wide on the top, and the masonry is composed of heavy blocks of stone laid with at least 12 inches of concrete between, composed of 1 part cement, 2 parts of sand and 5 parts of fine broken stone. All stone must be kept back 12 inches from the face of the bulkhead, and any stone showing a face of over 4 square feet must be kept back 18 inches from the face.


Plan.

Sectional Elevation.

ENGINEERING RECORD.

BULKHEAD AND PENSTOCKS.

A smooth face in concrete will be formed by laying 3 inches of 3 to 1 cement mortar against the forms, holding it in position by a light steel plate, then laying up concrete and drawing the plate, ramming the whole lightly together after the heavy ramming of concrete is completed.

The penstocks will be carried through the bulkhead in slightly conical shape, being 9 feet 6 inches in diameter at the mouth by 8 feet 6 inches where they project from concrete. There are six of these large penstocks, each of 5,000 horse-power capacity, and one of 3 feet 6 inches in diameter for the exciter wheels.

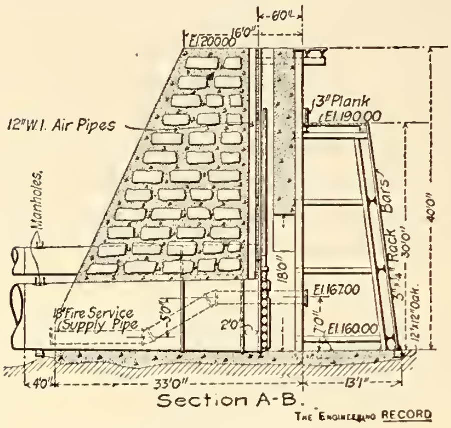
The danger of collapse from atmospheric pressure through sudden shutting of the gates and the withdrawal of water from the pipes, is provided against by having five vertical air pipes, 12 inches in diameter, extending up from the mouth of the pipes to the top of the bulkhead behind the gates. Two cut-off rings are placed on the outside of pipe to set in the concrete.

The gates are 10 feet high by 10½ feet wide, and are built of ⅜-inch plates on a framework of 10-inch I-beams, and slide on steel vertical strips bearing on T-bars riveted to channels bedded in the concrete. They are to be raised by pneumatic pressure from the power-house below, with properly regulated pistons to avoid any danger to the pipes through too sudden opening or closing of the gates. Each gate has a single shaft connected to two rods running through the whole height of the gate, and is so made that on commencing to raise the gate a section 12 inches high separates from the balance of the gate, and allows the penstock to fill with water, after which the whole gate is lifted together. The pneumatic pistons are designed, however, to open and close the gates under the total possible pressure due to a head of 40 feet.

The gate for the exciter pipe is of the same design but on a smaller scale.

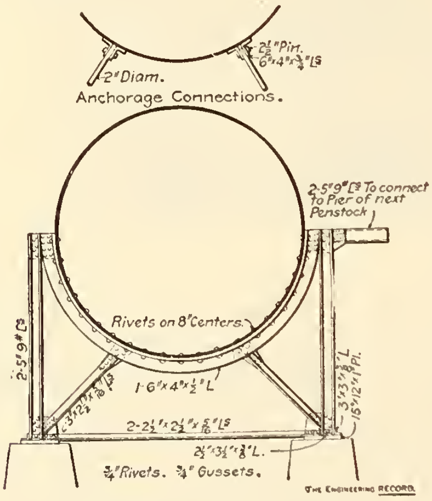
In addition to the gates the penstock entrances are protected by stop logs formed by 12-inch channel slides into which 12 x 12-inch timbers can be dropped in case of emergency.

The rack framing is formed of trestles of I-beams set on oak stringers bedded in concrete in the bottom. Three lines of 15-inch I-beams, running horizontally, support the rack, which is laid on a batter of 3½ feet in the height of 28 feet and is formed by 3x¼ inch bars spaced at 2-inches centres, with thimbles between, in sections 3 feet long. These sections are separated, and are supported on cast-iron blocks, bolted to the oak sill, of such a design that the section can be removed and replaced without the services of a diver. The sections are secured at the top against overturning by a hasp engaging in a staple spiked to the flooring of the rack platform. This platform is set 10 feet below the top of the bulkhead at a height where the rack can be raked conveniently for a greater part of the year.



SECTION THROUGH PENSTOCK.

Another narrow platform is set level with the top of the bulkhead. The ice chute previously mentioned forms a convenient means of disposing of all trash raked from racks, which can be worked along the racks and into the chute. A light glance boom will be placed in the head-race leading to the ice chute, so that no floating debris will come against the racks. The height of water floating through the ice chute will be regulated by stop logs at the entrance.



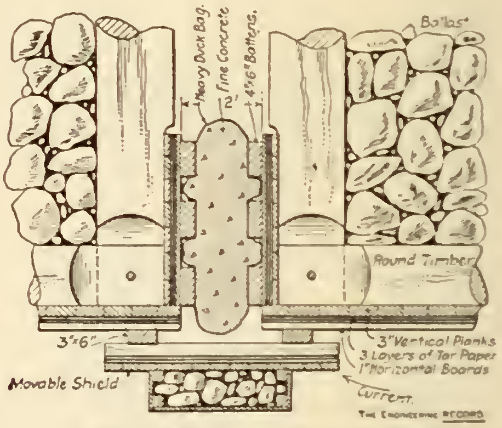
SADDLE CARRYING PENSTOCK.

Three of the large penstocks, two of them 500 feet long and one 650 feet long, will be laid at once. They will be lap-jointed on both longitudinal and girth seams at upper end, lap-jointed on the girth seams and but-strap jointed on the longitudinal seams at the lower end. The plates are 5/16 inch in thickness at the upper end and 7-16 inch at the lower end. The pipes will be supported on steel saddles 15 feet apart, riveted to the pipe and resting on concrete base piers. These saddles are built of channels and angles, with gusset plate connections. The angles on which the pipe rests being curved to fit the pipe. The bases of the saddles will be held down with 1-inch fox-bolts running through the piers into the solid rock. The saddles are designed to receive bolting and framing of wooden housing for the pipe. This housing is necessitated by the extreme cold and will also obviate trouble through expansion and contraction due to the changes of temperature. Anchor rods secured to angle connections on the pipe and to fox-bolts in the rock will counteract the tendency to slide down hill.

Two of these pipes will run to the main power-house of the company where they will each operate horizontal double turbine units of 5,000 horse-power with single generator units of the same capacity. The electrical apparatus will be supplied by the Westinghouse Electric & Manufacturing Company and the turbines by the I. P. Morris Company, Philadelphia.

The power-house foundations will be of massive rubble masonry in cement mortar and concrete. The walls will be built of stone, supporting steel roof trusses and track beams to carry an electric travelling crane of of 50 tons capacity.

The third pipe will be used by the Pittsburg Reduction Company in a separate power-house, discharging into the main tail-race. Two double turbine units of 2,500 horse-power with direct-current generator on each end, of 1,250 horse-power, will be installed in its power-house, which will have masonry foundations with brick walls, and steel framing for roof and travelling crane.



JOINT BETWEEN COFFER-DAM CRIBS.

The Shawinigan Carbide Company, a company formed to manufacture calcium carbide for the production of acetylene gas, has leased 10,000 horse-power with an option on 20,000 horse-power additional. It will erect works one mile from the power-house along the main line of the railway, its first building being a 150 x 000-foot structure, on a masonry foundations.

General surveys for the present development were conducted under circumstances of great hardship during the winters of 1897 and 1898, and during the summer of 1899 other extensive surveys were carried out, including those for an electric railway to Three Rivers and the location for the branch to the Great Northern Railway. The contract for the railway branch and work on the first development, including excavation, cribwork and masonry was awarded on May 15, 1899, to the Warren-Scharf Asphalt Paving Company of New York.

On May 23, 1899, work was commenced by opening up a wagon road 2½ miles long into the Falls. Work on the excavation in the head-race and the tail-race was commenced about August 1, 1899, and has been continued ever since, with the exception of about two weeks lost through an abnormal flood in October.

The head-race excavation was taken out by 12 guyed derricks, 55-foot booms, six on each side of the cut, set about 120 feet apart. These derricks, together with spoil tracks, were set on top of the bank about 40 feet above the finished bottom of the cut.

At the intake a temporary coffer-dam had to be constructed. This was commenced about September 15, after the logs had passed down the river, and was placed in six weeks' working time, being delayed about one month by the flood before mentioned.

This coffer-dam is 640 feet on the water line by an extreme height of 30 feet, and was placed, without accident of any kind, in a current running at from 3 to 5 miles per hour. It was placed 15 feet away from the limit of excavation, and extends right over to the top of the Falls. The sand and gravel, 5 or 6 feet in depth in deep water, was first removed by means of a 6-inch centrifugal pump, set on a scow with separate boiler and engine, and discharging into midstream. This sand and gravel was thoroughly cleaned off, so as to allow the cribs to set on solid rock.

To cut off the current through the opening, due to the water being lower on the inside than on the outside of the cribs, stop-gates were run down on the outside of the openings between the cribs. These gates were about 4 feet wide and 30 feet long. They were made of two layers of 2-inch plank with tarred felt between, and laid against vertical bearing strips on each crib, A ballast box on the outside of the gate was filled with stone and the gate sunk into position when the pressure of water made it bear tightly. The bolting of this coffer-dam was done with ⅞-inch round spikes driven into ¾-inch round holes.

The coffer-dam has proved so tight that the head-race behind it has been easily kept dry by one 8-inch centrifugal pump working at about half speed.

After the work of excavation is completed, the rock filling will be removed from the cribs with an orange-peel dredge bucket, and the timber taken off or allowed to go over the falls so as to leave no obstruction whatever at the entrance to the head-race.

It was originally expected that the bulkhead at the lower end of the head-race would be built simultaneously with the excavation in the head-race, but for various reasons was delayed until the frost made the laying of concrete inadvisable, and provision had to be made for its construction this spring.

The coffer-dam at the intake is exposed to the full force of the open river, and is not calculated to stand against floods, nor is it high enough to exclude high water. Further, it reduces the flood overflow area of of the river by one-half, and any attempt to raise it would increase the flood level of the river to a dangerous height. Therefore, a second cribwork dam has been constructed across the head-race, and it will protect the bulk-head site after the outside coffer-dam has been removed.

The coffer-dam is a single continuous crib built across on the level bottom of the head-race, and extended on the top of the bank on both sides to the high ground on the one side, and the cribwork permanent wing dam on the other side. This dam is 27 feet wide for a height of 23 feet, and 16 feet wide for its remaining height of 17 feet. It is of the same description of cribwork as the coffer dam at the intake, and is sheathed in the same manner.

Cross ties are framed 10 feet apart in each course, and staggered in alternate courses, forming 5 x 11-foot ballast pockets. These are filled with loose stone closely packed, and loose stone has also been piled on top of the offset between the widths of 27 feet and 16 feet, making the dam practically 27 feet wide from top to bottom. The joint between the crib and the rock sides and bottom is made with concrete and puddled clay, the clay in vertical corners being held in place by corner boards. Two flumes about 2 feet square are carried through the crib to admit water when required.

Another coffer-dam has been built in the tail-race to hold back high water while the power-house foundations are being built. This dam is 26 feet high, with cut-offs through the gravel to rock at each side, and is 200 feet long ; 160 feet of its length, where it rests on a clay bottom, is built with an inclined top in bents of heavy rough timber on 4-foot centres. This dam is 80 feet wide on the bottom. The covering is 2-inch and 3-inch dressed plank covered with two layers of tarred felt protected by 1-inch boards, the felt and the joints in the boards being swabbed with hot pitch. The toe of this dam is made tight with double sheet piling well puddled. The remaining 40 feet of the dam is formed of square cribwork, as previously described, 20 feet wide.

Water from the river is pumped by a Northey pump with 3-inch suction, and delivered to two storage tanks, one of which has a capacity of 2,000 gallons, and is elevated 75 feet. Service pipes from it supply boilers on both sides of the head-race.

There is a 15-arc light dynamo from the Royal Electric Company, Montreal, driven by a 35 horse-power Laurie automatic engine, and lamps are placed on each side of the cut for night work.

There is a camp for boarding 300 men. The maximum number of men employed has been about 1,200. In the summer it was difficult to keep the men on the work, but they were anxious to work through the severe winter weather, and the rock excavation and crib building was carried on almost uninterruptedly with a force of over 1,000 men.

Messrs. T. Pringle & Son, Montreal, are the engineers of construction : Mr. Wallace C. Johnson, Niagara Falls, is the consulting hydraulic engineer, and Mr. Wm. I. Bishop, Montreal, is the engineer in charge. Mr. D. A. Rexford is the contractor's superintendent.

At the annual meeting of shareholders of the Ottawa Electric Company a very satisfactory statement was presented. The company has now installed 87,114 incandescent lights, 644 arc lights, 163 motors, and 23 heaters, all distributed among 4,357 customers. This is a substantial increase over last year. During the year there was installed an electric storage battery of 250 cells which is employed as an auxiliary to the motor service. The board of directors were relected.

Mr. James Kent, general manager, and Mr. B. S. Jenkins, general superintendent, of the C. P. R. .Telegraph Co., have recently returned from a tour of inspection of the company's lines in the Northwest and British Columbia. Mr. Kent states that additional wire facilities of 1,000 miles will be provided this year to meet the increasing demands of the trade. A new wire has been put up between New Denver and Nelson, in the Kootenay, which will allow the duplicate system to be worked from Vancouver to Nelson and Rossland, and so double present facilities. The wires of the Manitoba and Northwestern system have been extended into Winnipeg, thus giving direct wire service between Winnipeg and all points on the Northwestern branch system.

MR. ALBERT MITCHELL.

As one of the many Canadians who have secured responsible positions in far-off lands, we present a portrait of Mr. Albert Mitchell. A few months ago Mr. Mitchell succeeded Mr. H. J. Somerset, as superintendent of the Winnipeg Street Railway, Mr. Somerset having been appointed manager of the street railway system at Perth, Australia. Mr. Mitchell subsequently resigned his position in Winnipeg to become superintendent of the street railway at Perth, a position carrying with it greater responsibilities and increased salary.

Mr. Mitchell spent his early years in Ontario, but left his home to learn the mechanical trade with the Vulcan Iron Company, of Winnipeg. He had only a common school education, but while learning his trade he took every opportunity to add to his store of knowledge and afterwards took a course in engineering and electricity in a technical school. He worked at his trade for twelve years and spent one year in building electric motors. In 1896 he accepted the position of chief engineer of the Winnipeg street railway, holding same until his appointment as superintendent. We bespeak for him success in his new field of labor.

Mr. Albert Mitchell.

BY THE WAY.

The following story is told by W. S. Churchill in his "The River War", of the manner in which General Kitchener improvised a reel for field telegraph work in the Soudan. "He walked to the largest coil of wire picked it up and approached the smallest donkey. He took the little animal's two hind legs in his left hand, and put them into the coil. He lifted the wire up until it passed around the donkey's back, like a horse collar, only that it hung between the fore and hind legs. He caught hold of the loose end of the wire and smacked the donkey with the other hand. The beast moved forward, tripping and stumbling over the wire, which began, albeit jerkily, to unwind. Then he walked abruptly back to his horse. By this method the Field Telegraph accompanied the Flying Column."

Mr. V. L. Emerson, of Ottawa, is reported to have invented a powerful automobile, which is designed to be operated by a hydro-carbon motor, at a speed of 30 miles an hour.

Under the direction of Mr. L. M. Lash and Mr. P. F. Sise, of the Bell Telephone Company, Montreal, a large new switchboard is being installed in the head office of the New Westminister and Burrard Inlet Telephone Company, of which Mr. H. W. Kent is the general superintendent. The cost of this new switchboard will be about $30,000.

PERSONAL.

Mr. Wilfrid Phillips has resigned the position of manager of the Niagara Falls Park & River Railway.

The authorities of Columbia University have granted for the third time the Tindall Scholarship to Prof. R. B. Owens, of McGill University.

Mr. Wm. Marconi spent the greater part of last month in Ottawa. He has returned to Europe but is expected back again a few months hence.

Mr. Thos. Ahearn, of Ottawa, accompanied by his family, is on his way to Europe. He will visit the Paris Exposition and spend some time in England and Scotland.

Mr. R. W. Angus, B.A., son of Mr. R. Angus, superintendent of E. Leonard & Sons, London, has been appointed lecturer in mechanical engineering in the School of Practical Science Toronto.

The death is announced at Brantford, Ont., of Mr. W. Barron, who was for many years manager of the Brantford street railway. The deceased had been some time previous to his death in poor health.

Mr. John G. Ridout, of the firm of Ridout & Maybee, patent solicitors, Toronto, has been awarded a premium by the Chartered Institute of Patent Agents, London, Eng., for one of the five best original papers read before the Institute this year.

Mr. P. McCullough, electrician at the power house of Toronto Railway Company, has resigned his position, and left on June 24th to take charge of the electrical department of the corporation tramways at Liverpool, England. Prior to his departure Mr. McCullough was presented with an illuminated address and a gold chronometer by the electrical and mechanical staff of the railway.

SPARKS.

A fire which occurred a few days ago in the sub-station of the Lachine Rapids Hydraulic and Land Company, Montreal, caused considerable damage to the machinery, and resulted in the death of the watchman.

The Dominion government have awarded the contract for a cable to connect Belle Isle with the Canadian telegraph system. The cable will be delivered in Canada within six weeks and within a month thereafter will be laid.

The gas and light committee of the Brockville city council have offered the sum of $85,000 to the Brockville Light and Power Company for its plant. The company have accepted the offer on condition that the council will pay for recent extensions, tools, and stocks at the cost price.

The Board of Control, of the Toronto city council, have passed a resolution recommending the city engineer to prepare an estimate of the cost of installing and operating a municipal telephone system for 6,000 and 10,000 subscribers. A committee of the council has also been appointed to consider the question.

Mr. Wm. Mouall, of Montreal, who is a member of the syndicate controlling the street railway franchise in Havana, has recently returned from Cuba. He states that the Cuban electric railway enterprise, in which Halifax and Montreal capitalists are interested, is showing satisfactory results. The net receipts for the first month's operation amounted to $6,000. The company are constructing a new line three miles long to the city of Gaunadacoa, where it is proposed to establish a pleasure park.

The Toronto Electric Light Company are having a tunnel constructed beneath the railway tracks on the Esplanade immediately opposite their works, in which to place the cables connecting with their underground system. The company, during the present year, have laid vitrified clay conduits enclosing cables on a number of the principal thoroughfares, including Front street, King and Queen streets as far west as Spadina avenue, Yonge and Queen street and up Terauley street to their station on that street.

The Bell Telephone Company have notified the fire department of Toronto to remove all fire alarm wires from the company's poles, otherwise they will hold the city responsible for any resulting damage. There are in use in the fire alarm system 870 poles belonging to the Bell Telephone Company, 470 poles of the G. N. W. Telegraph Company and 869 of the Electric Light Company. The G. N. W. Company has rendered an account for $200 for the use of its poles. The Electric Light Company says the city is welcome to use the wires free.

The project for the construction of an electric railway from Port Dover to Preston, via Simcoe, Waterford, Boston, Mount Pleasant, Brantford, Paris, Ayr, Blair, Doon, Berlin and Preston, is being brought prominently before public notice. It is proposed to acquire the Brantford Street Railway covering the City of Brantford, the Galt, Preston and Hespeler Electric Railway, with which connection will be made at Preston for Galt and Hespeler, and the Berlin and Waterloo Electric Railway with which connection will be made at Berlin. Connections will be made at Port Dover with the Shenanago Car Ferry running to Conneaut, or Erie, on the American side of Lake Erie; at Simcoe with the Wabash Railroad ; at Waterford with the Michigan Central Railway and Toronto, Hamilton and Buffalo Railway ; at Brantford with the Toronto, Hamilton and Buffalo Railways ; at Ayr and Galt with the Canadian Pacific Railway. The total cost of the road is placed at $1,500,000. It is stated that the greater part of the capital required has already been arranged for, and application is now being made for bonuses from the municipalities along the route.

ENGINEERING and MECHANICS

UTILIZATION OF EXHAUST STEAM.*

By E. P. Roberts.

Among the uses to which exhaust steam may profitably be put is heating the feed water. The heating of the feed water is the most common use, but it is not always understood how small a portion can possibly be utilized in this manner. If we have 3,000 pounds of water and the initial temperature of the feed-water be 60 degrees f. and the exhaust steam pass through the heater at atmospheric pressure it will heat the water to about 200 degrees f. For each pound of feed-water we merely require 140 heat units or a total of 420,000, or approximately one seventh. Evidently there will still be a large surplus. Often feed-water is not heated as hot as it might be without cost, and in such cases the saving to be made by the addition of suitable apparatus for raising the temperature of the feed-water will pay large returns on the investment. Having used all the exhaust steam needed for heating the feed-water there will still be a balance which may be disposed of in any of the following ways :

First, exhaust it into the atmosphere. Second, condense it and obtain the greater economy on the engine. Third, use it for heating buildings, etc., which to do in any instance will depend entirely upon the local conditions.

Upon the supposition that sufficient money is available for such improvements and extensions as will bring the largest percentage-returns on the total expenditure, a general statement can be made. Determine the first cost and additional cost of the operation, including in operating expenses an allowance for depreciation and repairs and determine the gross income ; the difference between the above will be the net profit. This is a simple proposition, but an accurate determination of the result requires a most careful examination of all the details of the proposition, and is far from being a simple matter. The second possibility is usually the easiest of determination. It is the advisability of condensing. The first step is to ascertain the existing conditions : First, how much steam is being used ? Second, the range of load—the nearer the average load is to the rated, the greater the economy from condensing ; on a very light load, condensing may cause a loss. Third, what pressure is carried, and what can be carried, and how long are the boilers good for such pressure ? Fourth, are the engines overloaded at times, so that more power is needed ? Fifth, are the boilers overloaded ? Sixth, is it possible to install new boilers or engines ? What will it cost ? Will the results cost more and be better or worse than if made condensing ? Seventh, what will it cost to put in a condensing system ? Is water available without cost except pumping ? If not what will a cooling tower cost ? Eighth, what is the character of the water ? If bad, will not surface condensers save a considerable amount by lessening scale in the boilers ?

These are the more important points to be considered and the value of each determined accurately, when the profitable utilization of the exhaust steam other than heating the feed-water is to be decided upon.

To find the largest expenditure for the condensing system that can be made to obtain a saving of one per cent., first find the total cost of fuel for the year. One per cent. of this amount will represent the interest on the maximum amount that may be expended in obtaining a net saving of one per cent.

The next consideration is the use of exhaust steam for heating buildings, etc. The subject of charges for heating is one deserving of considerable attention. Mr. Roberts in speaking of this matter said : "The correct basis of charge is evidently the amount of steam furnished. This evidently requires meters. Steam meters until recently, have been of the velocity type, and have given a greater or less degree of satisfaction, that is for meters. Meters are now made which record the water of condensation, and this is a correct measure. But exclusive of meter measurements, flat rates can be made in the heating business on a far more satisfactory basis than in lighting. Such basis is the the square feet of heating surface, and is fairly satisfactory, because a square foot will condense a certain amount of steam, and although such amount depends upon the initial temperature of the air to be heated, nevertheless the average for the year can be quite closely approximated. The principal objection to this basis is that customers are liable to regulate the temperature, not by closing off the steam but by opening windows. But even such objection is not a very important one when there is sufficient exhaust steam for use in the coldest weather, because it is the coldest weather which determines the maximum and at such time windows are not opened.

Sometimes the charge is based on the cubic feet of space to be heated. This is a very crude basis as in one case one square foot of radiating surface may be needed for 60 cubic feet of space and in another case we may heat to the same temperature 120 cubic feet or more. These figures refer to direct radiation. For indirect radiation, fan system, etc., the amount will be changed. By far the majority of steam heating is by direct radiation, although in any installation of considerable magnitude consideration should be given to each of the above methods."

The rules for heating of buildings are many and various but the following are given as having been found reliable in practice. Allow one-fourth square foot of radiating surface for each $\frac{2}{55}$ of the cubic contents for first floor rooms and halls ; the same amount of radiating surface for each $\frac{1}{55}$ of cubic contents of room for second and upper floor rooms, and one-fourth square foot of radiating surface for each square foot of glass surface plus that of exposed wall. Wolff gives the following allowance for special conditions : Increase ten per cent. for northerly exposures subject to wind, and ten per cent. when the building is heated during the day time only and when the building is not exposed. Increase 30 per cent. when the heating is done in the day time only and when the building is much exposed. Increase 50 per cent. when the building is heated during winter months intermittently at long intervals. The above factors make a considerable modification and what factor to use in any given case is a matter of judgment based on experience.

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*Abstract of paper read before the Ohio Electric Light Association.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Toronto No. 1.

At the last regular meeting of Toronto No. 1 Canadian Association of Stationary Engineers, held on June 20th, 1900, the following officers were elected for the ensuing year,—President, J. Huggett ; vice-president, W. J. Webb ; recording secretary, J. Marr ; financial secretary, N. Kuhlman ; treasurer, S. Thompson ; conductor, W. Butler ; doorkeeper, G. D. Bly ; trustees, G. Mooring, C. Moseley, Jas. Bannon ; delegates to convention, J. Huggett, W. J. Webb, H. Terry, A. Storer, N. Kuhlman.

Hamilton, No. 2.

At the last regular meeting, June 19th, 1900, the following officers were elected :—President, Thos. Chubb ; vice-president, F. J. Scutthorp ; recording secretary, Jos. Ironside ; financial secretary, Jas. Carrol ; treasurer, W. R. Cornish ; conductor, Jas. Wadge ; door-keeper, Jas. Cook ; delegate to convention, Bro. Geo. Mackie; alternate, Geo. Dawson.

Annual Convention.

The eleventh annual Convention of the Canadian Association of Stationary Engineers will be held in Toronto, commencing August 21st next. The meeting place will likely be the Engineers' Hall, 61 Victoria street. The local Association have already made preliminary arrangements for the entertainment of the delegates, and one of the most successful conventions yet held is predicted. In next issue further particulars will be given.

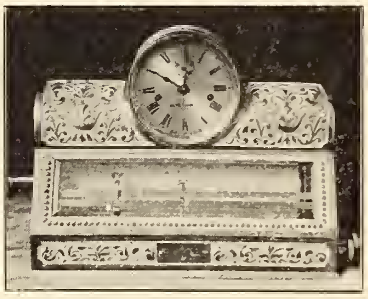
The Canadian Association of Stationary Engineers, of Montreal, have elected the following officers for the ensuing year :—President, H. F. Thompson ; first vice-president, F. D. Jones ; second vice-president, H. Wady ; secretary, past president W. Smythe ; treasurer, past president T Ryan ; financial secretary, H. Nuttal ; conductor, J. Carr ; doorkeeper, H. Knight ; trustees, past president J. J. York, past president G. Hunt, past president W. Weir.

The Electric Reduction Co., Buckingham, Ont., is installing two 25 k. w. direct current generators supplied by the Royal Electric Co.

THE MARTIN AUTOMATIC RECORDER AND REGISTER.

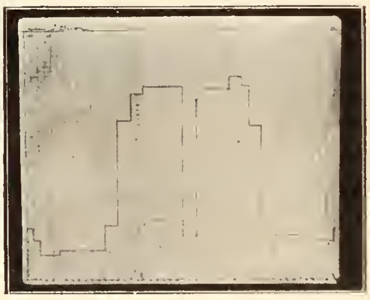
This device, as shown in the cut, is for drawing load curves, such as the total output of one or more switchboards, also to check the time when the readings are taken. The recorder carries a two months supply of cross section paper, made up in the shape of daily charts (Fig. 2). These charts pass out at the back of the recorder, once every twenty-four hours. They are kept moving at the same rate as time by the clock, which is geared to the roller which carries them forward.

The attendant when taking the reading, every fifteen or thirty minutes as the case may be, records the reading by turning a milled headed nut on the right hand side of the recorder, which moves the pens along a scale to correspond to the amperes. He must record at the proper time and cannot neglect several or any readings, and then jot them down by guess work and fil in his report.



Referring to Fig. 2, the column of figures on the left are for a D. C. switchboard; they are printed in red ink and the curve is also drawn in red ink. The column on the right is for an A. C. switchboard; these are printed in blue ink and the curve is also in blue ink. The idea is to be able to distinguish the two curves as they may cross or recross each other during the twenty-four hours.

The charts can be printed for other purposes such as to show a voltage curve and an ampere curve, or both for amperes, etc. The figures at the top and bottom of the chart show the time starting at 12 o'clock midnight, until the following 12 o'clock midnight (24 hours). By referring to the chart it is readily seen at any time what the load was on each switchboard. The charts can be filed and kept for future reference to compare the output of the station for the different days, months or years, etc.



The recorder is provided with a stamp on the left hand side which the attendant operates by pressing a button at any time when the loads have not changed since the last reading, thus showing that he was at his post. The recorder being locked up by the manager or superintendent, the pens carrying at least enough ink to last a week, it will be seen that it is not necessary for the attendant to have access to the recorder only from the outside. It is neatly finished in white nickel, and looks very attractive, mounted with a Seth Thomas eight day clock, and constructed so as not to get out of order. Made by the Martin Automatic Recorder and Register Co., Hamilton, Ont.

At the request of the city council the city engineer has prepared an estimate of the cost of installing and operating a municipal lighting plant. The figures which he has submitted are as follows: The buildings and plant would cost $950,000, and the cost of installing an arc lighting plant, with a capacity of 1,350 lamps, would be $300,000. If the electric wires were placed underground in the central portion of the city, the cost would be about $510,000. The annual cost of operating the plant with overhead wires would come to about $63 per lamp per annum, or about 17.2 cents per night. Using underground wires, the cost would reach $70 or 19.16 cents per lamp per night.

ARMOURED CABLE.

MESSRS. Jack and Robertson, of Montreal agents for the Sprague Electric Company, New York, have sent us the following in reference to armoured cables :

Our principals in New York, have now turned out a new and modern article, namely Armoured Flexible Cable for Conduit work. The Sprague Electric Company, owning all the patents and equipments of The Interior Conduit & Insulation Company, has, like its predecessor, led the progressive march of improvement in the manufacture of conduit and kindred appliances, and in answer to a persistent demand from some of the leading engineers in this country for further development in the art of electric wiring, is now ready to announce another period in the art-one more mile-stone in the path of progress and a near approach to the highest ideals of those who are mindful only of the interests of electrical developments.

For many years certain engineers have questioned the advantages of a "drawing in" system of interior wiring, involving as it does, two distinct and expensive operations, one being necessary for the installation of the conduit, another for that of the conductors, and base their argument on the fact that considerably less than one tenth of one per cent. of the electric conductors in buildings are subject to disturbance or removal.

With this condition recognized we then have the question—Why must the burden of two installations be imposed on the user of electric current, when only one should be necessary?

Two replies have invariably been ready for this question—First, the absence of definite knowledge regarding the life of insulation. Second, the entire absence of any suitable flexible armour or covering that would protect insulation from mechanical injury. The doubt expressed in the first argument has been removed by time, there being innumerable installations made from ten to fifteen years ago, and in which the wires show a higher insulation resistance to-day, than was obtainable immediately after they were placed in position.

The Sprague Electric Company now replies to the second argument by placing upon the market the Greenfield Flexible Steel Armoured Cable, comprising electric conductors so insulated and braided as to be thoroughly protected from atmospheric influences and armoured so as to defy any mechanical injury incidental to installations in the fire-proof or other buildings of the present day.

Engineers will recognize the advantages of flexible conductors so thoroughly insulated and armoured for use in marine or ship wiring where a rigid conduit system can only be installed at great cost in order to overcome the many obstacles presented by reason of the form of a vessel's structure, the small space available for equipment and fittings, excessively high temperatures, and incessant vibration of the ship.

Factory and mill wiring has hitherto been accomplished chiefly by the use of insulating knobs and cleats, moulding being used in some cases for the larger conductors. Where insulators and cleats are used, as in the majority of such work, the wires, being run from beam to beam, become dust collectors of the best kind, and especially is this the case in cotton and flour mills where the conductors will support an accumulation of lint and fine dust many times exceeding their own size. Perhaps the most costly feature of "open wiring" in such places is the general destruction caused by the breaking or slipping of a belt, which, when once fast caught in the wiring usually brings down several sections, sometimes wrecking or disabling valuable machinery by the operation. These objectionable possibilities are entirely eliminated by the use of "Greenfield Flexible Steel Armoured Cables" and "Cords" which can be firmly secured on the surfaces of the structure wired.

Finished buildings frequently present to the engineer and contractor wiring problems he would prefer to avoid, the alternative being in many cases the practical ruination of handsome, trim and costly decorations or the fishing of conductors without conduit from outlet to outlet, leaving their insulation as legitimate prey for the tools of the mechanic or the teeth of the ever-cheerful and busy rodent, in direct violation of the rules of safe construction. In such buildings "Greenfield Flexible Steel Armoured Cables" can be "fished" from pockets cut at convenient points and may be left with the full knowledge that they are absolutely secure from mechanical or other injury.

New buildings equipped with electrical conductors in accordance with the practice of the present day, require, as before stated, not less than two distinct installations—one of conduits, another of conductors.

The electrical contractor is compelled to make the progress of his work conform to that of other workmen, and is often subjected to costly delays. Alterations from original plans, however necessary or desirable, are in most cases costly in the extreme and sometimes impossible. Under the most favorable conditions, the electric wiring equipment is suggestive of a certain feeling of doubt amounting almost to distrust, and lacks that element of permanence and stability with which it should be associated and to which it is justly entitled.

This Company as the leading conduit manufacturers in the world, might well foster these ideas and practice and cater to them, but in the interests of the public and of the advancement of the art, it seems fitting that we should at this time introduce a new feature in electric wiring, one which at once reduces its cost and places in the front rank of permanent equipments with which the modern building is provided. We feel that this has been accomplished by the development of the "Greenfield Flexible Steel Armoured Cables" for which we ask from architects, electrical engineers and constructors their most favorable consideration.

These flexible products have been fully approved by the Underwriters' National Electric Association.

SPARKS.

Mr. Laliberte, chairman of the harbor committee of Quebec, has submitted to that body a project for utilizing the power of the tides of the harbor, for the operation of grain elevators and industrial concerns.

The Citizens Electric Company, Limited, of Smiths Falls, Ont., has been incorporated, capital $35,000 ; president Mr. J.H. Gould, secretary Mr. J. S. Gould. The company are enlarging their works and further developing their power.

The promoters of a number of new pulp mills, for the manufacture of pulp and wood products, to be erected twelve miles above the falls of the St. John river, propose to utilize the power of these falls to generate and transmit electricity to the works.

The annual financial statement of the St. John, N.B., Street Railway Company shows a net profit for the year of $37,792.53, out of which two 3 per cent. dividends were paid amounting to $30,000. The old Board of Directors was re-elected.

A contract has been given by the provincial government, to the Cataract Power Company for the supply of current necessary to light the building and grounds of the asylum for the insane. Provision is made for 1,100 incandescent lights for the building, and 10 are lights for the grounds, with wiring capacity for 1,500 lights.

The Dominion Government have received an application from Hon. Fred. Peter, formerly Premier of Prince Edward Island, and E. O. Fador, for certain shore rights in the harbor of Vancouver, B. C. They propose to utilize the tides to generate electric power, which will serve Vancouver, New Westminster, etc., and at the same time provide cheaper power.

It is reported that a large number of men are at work on the power development scheme of the Metropolitan company at Brittania. It is stated that the construction of the power station will be commenced during the present month. The cofferdam built last year, is being demolished, it having been found to be defective. Another one will be built at the other end of the channel.

Mr. J. P. Graves has made an offer to purchase from the city of Grand Forks, B. C., the water works and electric light plants at the sum of $70,000 and to expend $30,000 additional in improving the system. He also seeks to acquire an exclusive street railway franchise. The ratepayers will be asked to vote on the question. In return for a bonus of $30,000 Mr. Graves offers to provide water works, electric light, and trolley systems for the city of Columbia.

MOONLIGHT SCHEDULE FOR JULY.

Day of Month.	Light.		Extinguish.		No. of Hours.
		H.M.		H.M.	H.M.
1....	P.M.	9.00	A.M.	3.30	6.30
2....	"	9.30	"	3.30	6.00
3....	"	9.50	"	3.30	5.40
4....	"	10.20	"	3.30	5.10
5....	"	10.50	"	3.30	4.40
6....	"	11.20	"	3.30	4.10
7....	A.M.	0.00	"	3.40	3.40
9....	"	0.40	"	3.40	3.00
10....	"	1.30	"	3.40	2.10
11....	No Light.		No Light.		....
12....	No Light.		No Light.		.....
13....	No Light.		No Light.		.....
14....	No Light.		No Light.		.....
15....	P.M.	8.00	P.M.	10.30	2.30
16....	"	8.00	"	11.00	3.00
17 ...	"	8.00	"	11.30	3.30
18....	"	8.00	"	11.45	3.45
19....	"	8.00	A.M.	1.00	5.00
20....	"	8.00	"	1.30	5.30
21....	"	8.00	"	2.10	6.10
22....	"	8.00	"	3.00	7.00
23....	"	8.00	"	3.50	7.50
24....	"	8.00	"	3.50	7.50
25....	"	8.00	"	3.50	7.50
26....	"	7.50	"	3.50	8.00
27....	"	7.50	"	3.50	8.00
28....	"	7.50	"	3.50	8.00
29....	"	7.50	"	3.50	8.00
30....	"	7.50	"	3.50	8.00
31....	"	8.20	"	3.50	7.30
			Total.........		148.25

WESTINGHOUSE
TYPE "C" INDUCTION MOTORS

For Driving
Machinery,
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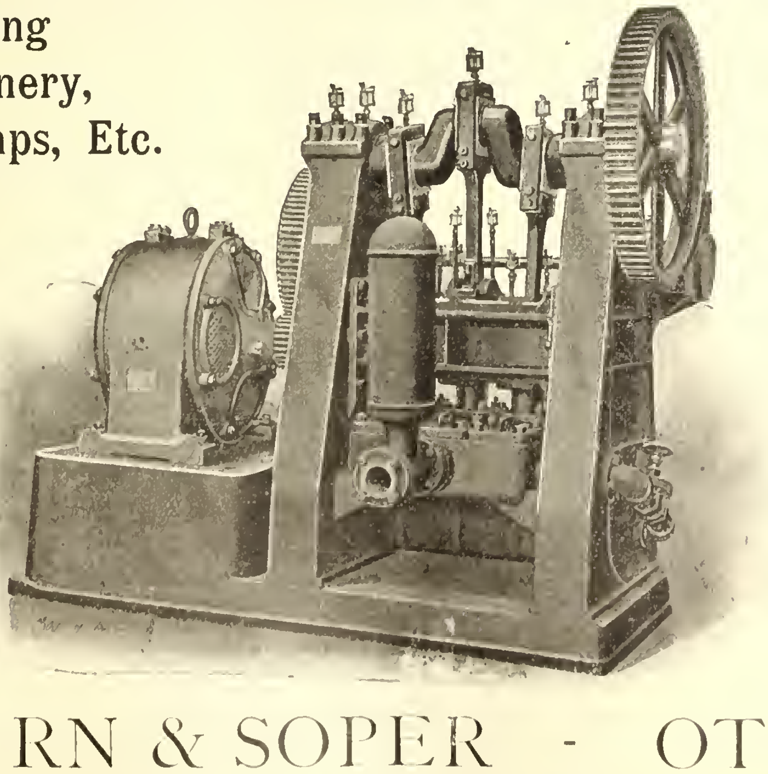

AHEARN & SOPER - OTTAWA
AGENTS FOR CANADA

TRADE NOTES.

The Anchor Knitting Co., Almonte, Ont., are installing a 10 k. w. multi-polar direct current generator, supplied by the Royal Electric Co., to light their factory.

The Granby Consolidated Mining & Smelting Co., Grand Forks, B. C., is installing a 10 k. w. multi-polar direct current generator purchased from the Royal Electric Co.

The Shawinigan Water & Power Co., Shawinigan, Que., is installing a 150 k. w. "S. K. C." two-phase inductor generator purchased from the Royal Electric Company.

Mr. Clayton, manager of the Central Electric Co., of Portage La Prairie, while on a trip through the East a few days ago placed an order with the Royal Electric Co. of Montreal for one of their 150 k. w. "S. K. C." two-phase generators.

The Penetang & Midland Street Railway Light aud Power Company, Penetang, Ont., has greatly increased its incandescent lighting business and has purchased a 150 k. w. "S. K. C." two-phase generator, complete with exciter and switchboard from the Royal Electric Company.

The Brantford Electric & Operating Co., Brantford, Ont., who have been furnishing arc and incandescent lights and operating motors from a 180 k. w. "S. K. C." successfully for the past four years are largely increasing their power and lighting business and have ordered from the Royal Electric Co., a 360 k. w. "S. K. C." two-phase machine.

SPARKS.

It is reported that an American firm of manufacturers of electrical machinery and supplies are considering the advisability of establishing a branch factory in Ottawa.

Representatives of a number of Street Railway Companies in Ontario met in Toronto recently and arranged for circuit entertainments to be given in the parks owned by the companies.

The employees of the British Columbia Electric Railway Company held their annual picnic on June 13th, in Queens Park, New Westminster. A good programme of athletic sports was provided.

Robt. C. Trouax, electrician for the Thousand Island Park Association, was killed by an electric shock on June 23rd. It is thought that while closing the circuit his hand touched the contact bar.

Extensive improvements are being made to the Bell Telephone Company's system at Winnipeg, and communication is being established with Portage La Prairie and a number of other outside towns.

It is said to be the intention of the Ontario Power Company to begin the construction of development works this summer. The company claim to have received applications for 30,000 horse power.

Work was recently commenced on the long distance telephone line, between Winnipeg and Brandon, via Portage La Prarie. The line is already completed to a point sixteen miles west of Winnipeg.

Niagara Falls are to be illuminated by electricity during the coming Buffalo Exposition. By means of searchlights placed on both sides of the river, the colours of the lights which are thrown on the Falls will be constantly changed. Arc lights will also be placed in the Cave of the Winds, which will give to the water which falls in front of it a phosphorescent effect.

Work will shortly be commenced on the construction of a new power house for the Ottawa Street Railway Company. It will be a duplicate of the present power house, will be entirely fireproof, and will cost, including water wheels and plant, about $150,000. The plant will include a 2,000 horse power generator, now being manufactured by the Westinghouse Co., at Pittsburg, and four large water wheels.

Mr. J. G. Macklin, of the Royal Electric Co., Montreal, has prepared plans and data at the request of the Renfrew Power Company, for the utilization of the power of the Bonnechere river. Mr. Macklin estimates that when the water is lowest, 725 horse power can be obtained, and at high water 1,500 horse power. The estimated cost of the development of this power is $40,000. The company is now applying for a charter and has elected the following provisional directors :—Messrs. A. Barnet, P. S. Stewart, John Ferguson, M. P., W. A. Mackay, Dr. Murphy and Thos. A. Low.

Some time ago the council of Winnipeg gave notice of its intention to discontinue its arrangement with the Bell Telephone Company, under which the company operated the city fire alarm system. Quite recently the mayor requested the company to continue the operation of the system for a few months longer until the city could complete arrangements for taking it over. In reply the company stated that having made arrangements to occupy the space used by the fire alarm instruments, they were not in a position to accede to this request, but would be willing to renew the contract for a further period of three years. To this proposal the city would not consent, and thus the matter stands.

The annual meeting of shareholders of the Canadian Electric Light Company was held at Quebec on June 26th. The annual report of the directors, submitted at this meeting, showed that the development works are well advanced and will probably be completed by the end of September. Contracts have already been made for 3,000 lights, and it is expected that operations will be commenced with a lighting load of 5,000 to 6,000 lights. Negotiations are in progress and are proceeding satisfactorily, for lighting the streets of the town of Levis. Applications have also been received for power from several manufacturing concerns. Tenders have been received for the laying of a sub-marine cable to carry current from Levis to Quebec, and the right has also been secured from the Quebec Bridge Company to use their bridge for the like purpose. The shareholders will be asked to authorize the issue of additional stock or debentures to complete the works. The probable revenue for the first year is estimated at $25,000, and the operating expenses at $1,000 per month.

The Smoke Nuisance and Big Fuel Bills

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THE REDPATH-REID AUTOMATIC SMOKE CONSUMER

THE Most perfect Fuel Economizer and Smoke Consumer in the World. Endorsed by the best master mechanics, engineers and coal users in the country. Every machine put on with a guarantee to consume 95% of smoke and a saving of from 10 to 20% in fuel. Can be used on any furnace. Patent rights for sale for Nova Scotia, Newfoundland, and a number of the States of the Union.

For further particulars apply to . . .

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WATCH THIS SPACE NEXT MONTH

Travelling Cranes
Electric or Hand Power.
Brown and High Speed Engines
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Pumps and Pumping Machinery
Impulse Water Wheels

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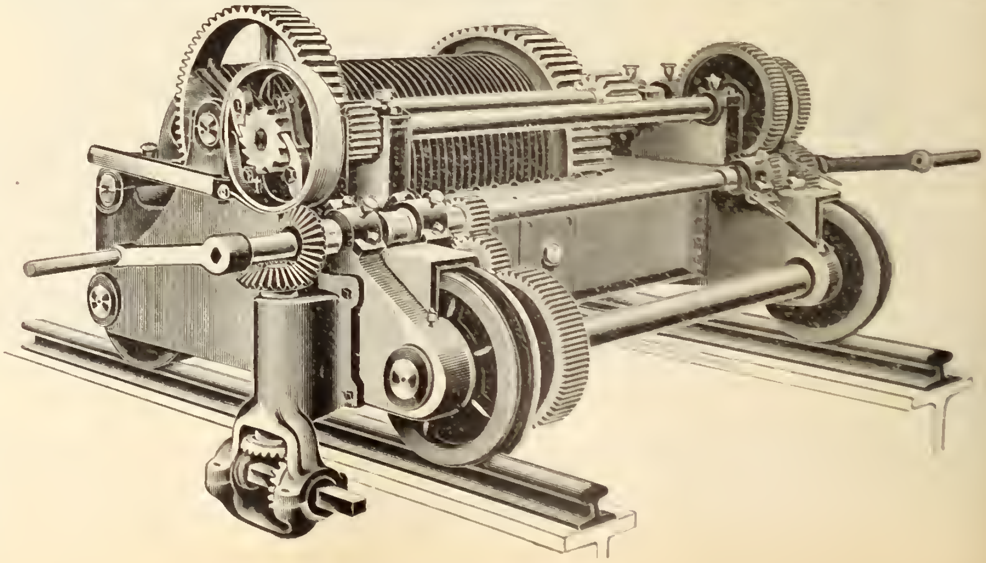
SMART-EBY MACHINE CO.
LIMITED
189 BARTON ST. E. - HAMILTON, ONT



SPARKS.

While repairing the fire alarm system Edward J. Tremblay, a lineman in the employ of the city of Hull, came in contact with the Hull Electric Company's wires charged with 2,000 volts, and was instantly killed.

A company is being organized at Ottawa to manufacture a new form of gas, which is said to be composed of 93 per cent. of air and 7 per cent. of illuminating mixture. The process of manufacture is thus described: An electric motor worked automatically at intervals during an hour, collects a certain amount of air into a blower. The air then goes into a chamber containing acid, and passes from there into a place containing carbonators. The acid chamber robs the air of carbon, and when the air goes into the carbonators it is practically pure oxygen and non-poisonous. In the chamber containing the carbonators there are wicks saturated with the illuminating mixture which is supplied from a receptable attached to the apparatus. The atmosphere in passing into the carbonators is combined with 7 per cent. of the illuminating mixture. The gas finally goes into the chamber from which it may be used. As the gas becomes exhausted in the tank out of which it is drawn for light, an automotic arrangement causes the electric motor to work and send in more air. The electric motor, beyond sending in the air, has no connection with the gas making machine. In fact, a system of weights could be used instead of a motor. The light produced is said to be pure white and 7 times stronger in illuminating power than a 16-candle electric light. The cost of production is said to be only $100 for 250 lights. The gas is employed for heating as well as for lighting. Messrs. J. R. Booth, J. A. Saybolt, and Capt. C. Foxwell are said to have secured control of the process of manufacture for Canada.

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THE INTERNATIONAL CORRESPONDENCE SCHOOLS,
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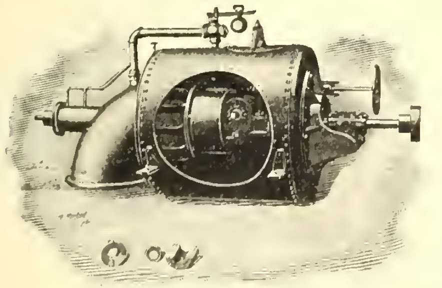
THE
Crocker Improved Turbine
In Horizontal Setting, with Quarter Turn Elbow.

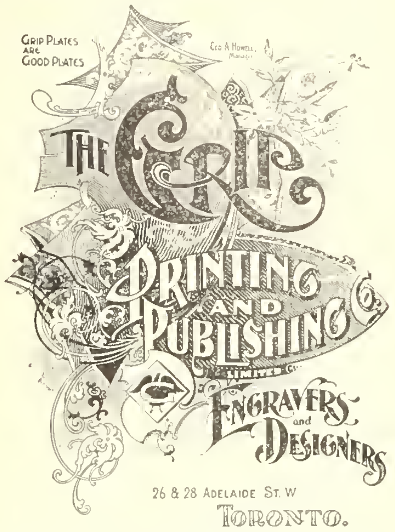


Where the nature of the location will permit its use this type has many advantages. It is very suitable for direct connection to dynamos, and many are in operation in this class of service.

Notice how complete and compact this arrangement is, and how easily it may be installed. Can you use anything of this kind? Your inquiries will receive prompt attention.

Water Powers examined and Reports made.
Estimates submitted for Complete Equipments.

The JENCKES MACHINE CO.,
Lansdowne St., Sherbrooke, Que.



VICTOR
TURBINES
OPERATING DYNAMOS

That there are more Victor Turbines in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.

FEATURES WORTH REMEMBERING
High Speed, Close Regulation, Great Capacity, High Efficiency, Perfect Cylinder Gate, Steady Motion.

RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Quebec Railway, Light & Power Co., Quebec, 1,000 h.p.; The Ottawa Electric Co., Ottawa, Ont., 2,000 h.p.

CORRESPONDENCE SOLICITED

THE
Stilwell-Bierce &
Smith-Vaile Co.
278 Lehman Street,
DAYTON, OHIO, U. S. A.

SPARKS.

Messrs. Wm. Moore & Sons, Meaford, Ont., have purchased a 1000 light alternator from the Royal Electric Co.

The Penetanguishene Electric Light Company have contracted with the Royal Electric Company, of Montreal, for a new 3,000 light dynamo.

Mr. Thos. Low, of Renfrew, Ont., is forming a company to develop the water power of the Bonnechere river. It is intended to spend about $40,000.

By the explosion of a boiler in the Dominion Iron & Steel Company's quarries at Sydney, C.B., the engineer, Mr. Perry, of Londonderry, was killed.

The town of Hespeler, Ont., will submit a by-law to the ratepayers to provide $10,000 for the purpose of taking over the electric light plant of Mr. Shantz.

By coming in contact with a live wire in the power house of the Lindsay Light, Heat & Power Company, at Fenelon Falls, Ont., engineer Poole was instantly killed.

The ratepayers of Bracebridge, Ont., will vote on a by-law on July 16th to raise $6000 by the issue of debentures for the purpose of developing power for the generation of electricity.

The Ottawa Electric Company has just awarded a contract to the Stillwell-Bierce and Smith-Vaile Company of Dayton, Ohio, for water-wheels for their new electric light station.

The Brantford Electric & Operating Company have just decided to build a new power house. All the machinery will be raised 10 feet above the highest flood level known. The estimated cost of the proposed improvements is $30,000.

A piece of steel was successfully removed from the eye of one of the employees of the Canada Atlantic Railway, by means of a magnet in the office of the Ottawa Electric Company.

Col. Tracey, City Engineer of Vancouver, B.C., has reported for the corporation of Revelstoke, B. C., as to the value of the Revelstoke Company's plant, which will probably be taken over by the town.

The Bowmanville Electric Light Co., Bowmanville, Ont., has been compelled, by a large increase in its business, to purchase new machinery, and has ordered from the Royal Electric Co. a 90 k. w. two-phase "S K. C." inductor alternator.

Mr. Matthew Neilson, C. E., of Almonte, manager of the St. John, N. B., electric railway, has recently returned from Jamaica, where he was engaged for several months in superintending the construction of an electric railway for his company.

No further action has been taken by the Ottawa city council towards granting a renewal contract to the Ottawa Electric Company, and on the other hand no steps have been taken by the company in the direction of negotiating with the city for the sale of its plant.

Joseph Geddes, an electrician in the employ of the Chambers Electric Light & Power Company at Truro, N. S., recently came in contact with a live wire while working with an arc light. He was severely burned on the head and hands, but recovered from the shock.

A scheme is said to have been decided upon by the interested concerns for improving the Chaudiere water power at Ottawa. It is understood that all obstructions will be removed and the intakes enlarged, and that the work will cost about $50,000. The The Ottawa Electric Company, McKay Milling Company, J. R. Booth, and others are interested.

Contracts have been awarded for the erection of a handsome new building in Montreal to serve as the headquarters of the Canadian Pacific Telegraph Company. The new building will be erected on the site of the old one which is now being torn down. It will have a frontage of 100 feet on Hospital street, 45 feet on St. Francois-Xavier street, and 51 feet on Exchange Court. It will consist of eight stories, the lower stories to be constructed of New Brunswick sandstone, and the upper stories of mottled pressed brick. Modern skeleton steel construction will be employed, and the structure will be made fire-proof throughout. The operating room will be located on the eighth storey with an entrance on the corner of Hospital and St. Francois-Xavier street, and a second entrance on the last named street for employees and messengers. The ground floor will be occupied by the Company's offices. The main entrance will be on Hospital street.

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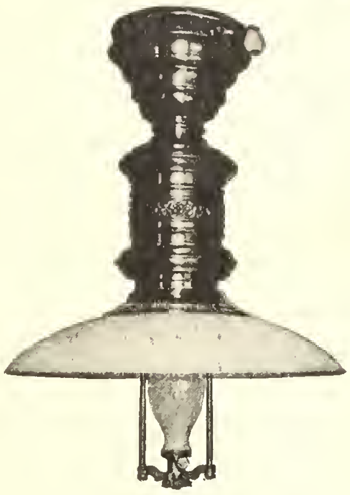

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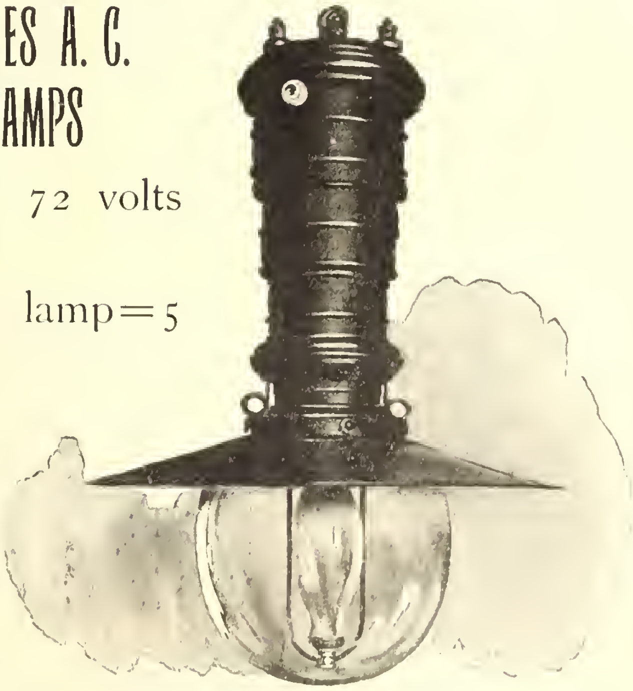

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SPARKS.

The ratepayers of Paris, Ont., will offer Mr. Melbrum $8,000 for his electric light plant.

Mr. John Sutherland, of Ottawa, is endeavoring to form a company to establish an automobile factory in that city.

Work has been commenced at Cascade, B.C., on the power house development scheme of the Cascade Power & Light Company.

The town council of Cannington, Ont., will submit a by-law to the ratepayers to raise $7,000 for the purchase of a municipal lighting plant.

The best way of testing the balancing of armatures says a contemporary, is to mount them in bearings which are free to move; then while the armature is running, the heavy side can be found with a piece of chalk, and counterweights adjusted on the opposite side until the cessation of movement of the bearings shows that the centre of gravity coincides with the axis of the shaft.

A company composed of Winnipeg capitalists and business men, has been organized under the name of the Lac du Bonnet Company to transmit electricity for power and light, from a water power at Lac du Bonnet to the city of Winnipeg, a distance of 62 miles, using a voltage of 40,000 volts. Plans have been prepared for the power house and plant. The building is to be 317 feet long, by 56 feet wide, and will be thoroughly fire proof. A gallery which runs the whole of one side of the building is designed to receive the switchboards, leaving the main floor to be used for the generators and transformers. On the main floor will be placed 20 direct connected generators, each of 1000 kilowatts capacity. Step-up transformers will be employed to raise the voltage to 40,000 volts. The water wheels, dynamos and transformers will rest on stone arches. The flume will be 72 feet long, 16 feet wide and 10 feet deep.

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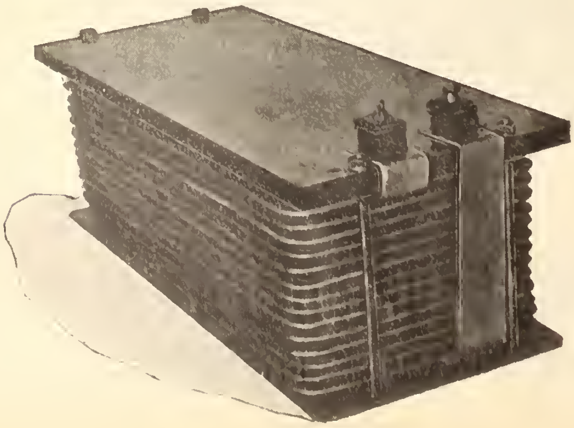

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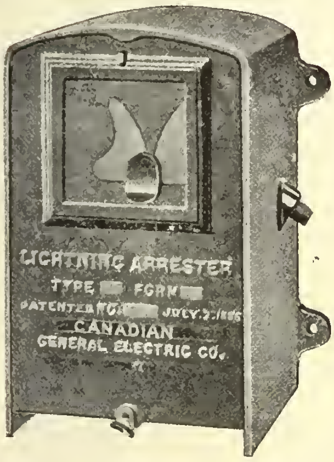

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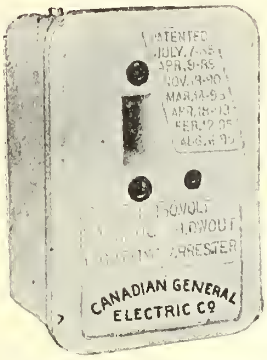

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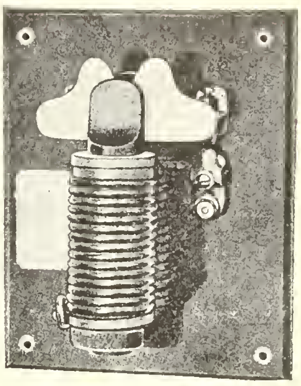

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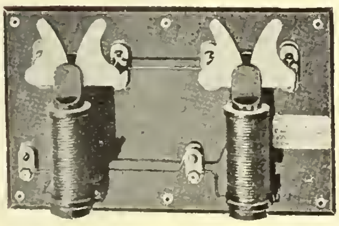

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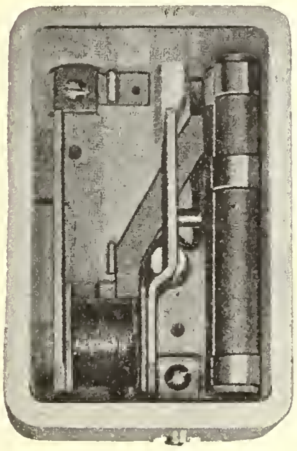

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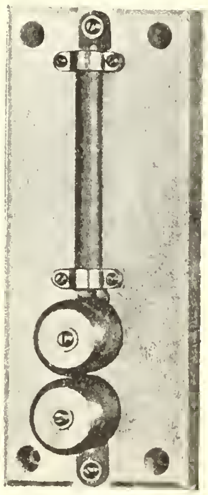

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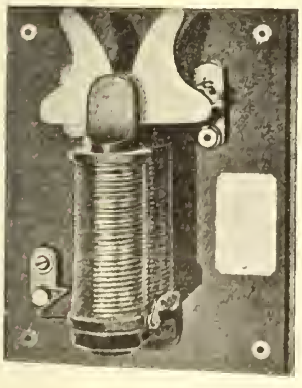

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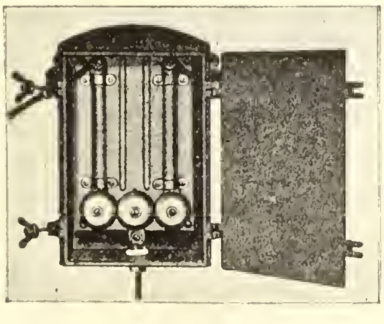

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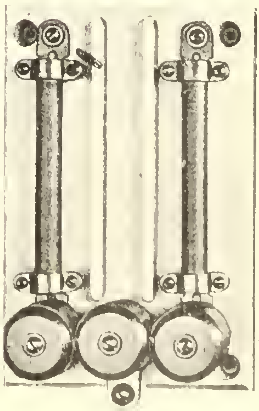

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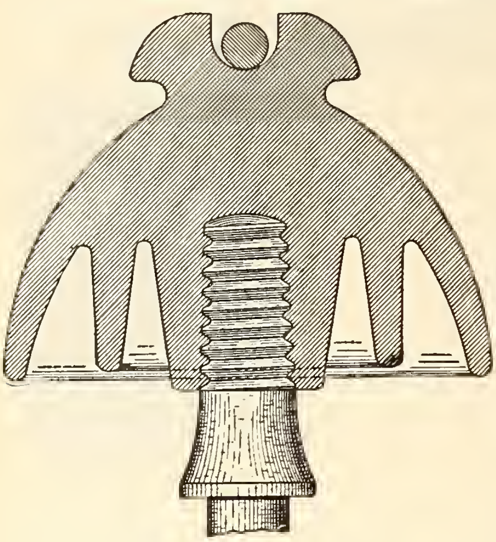

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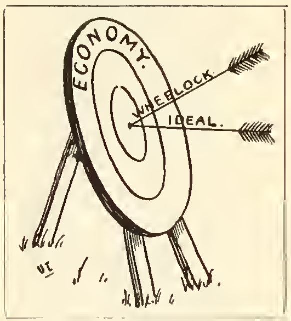

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Scientific American, Oct. 14, 1899.

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N. Y. Evening Post, Oct. 9. 1899.

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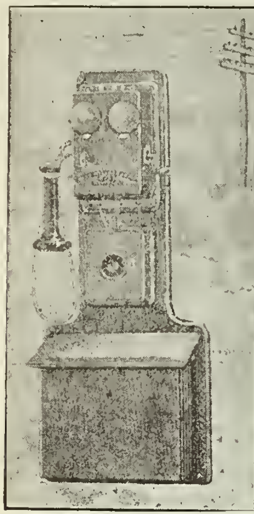

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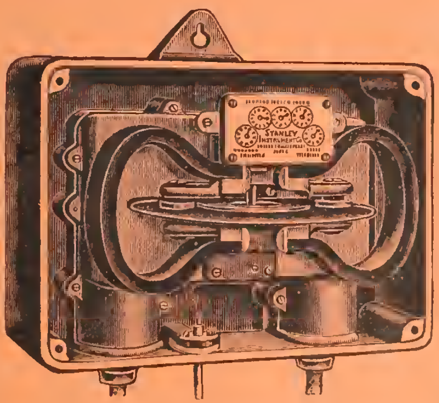

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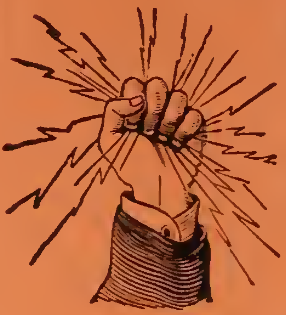

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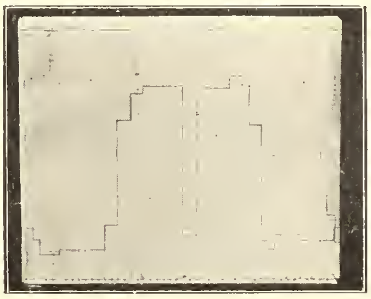

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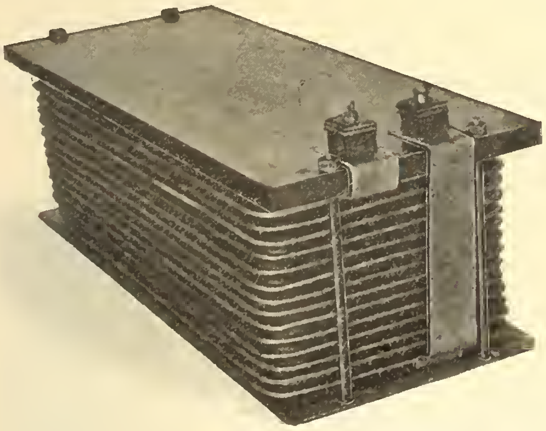

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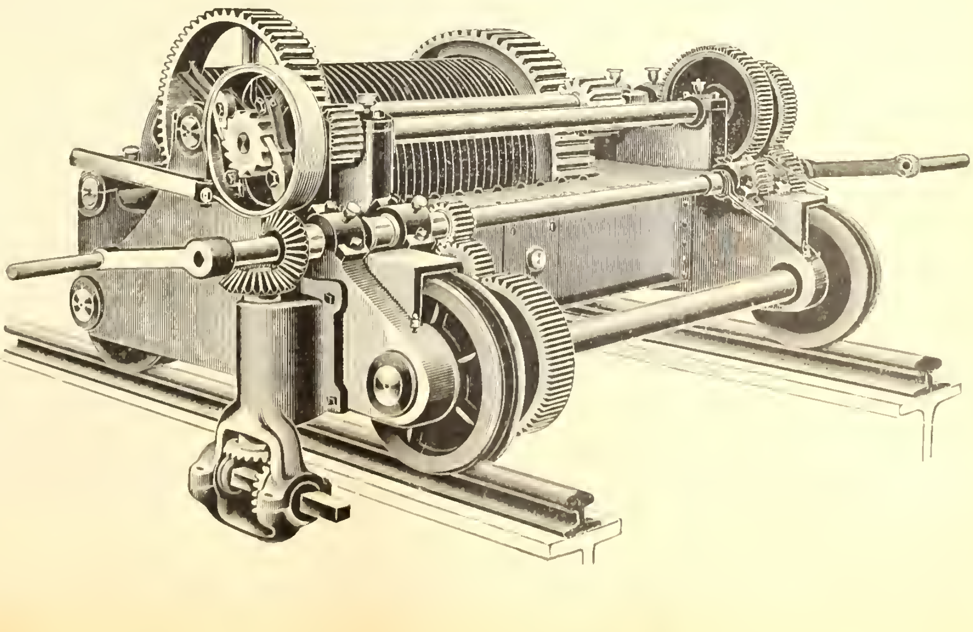

PERSONAL.

Mr. J. J. Ashworth, late of the staff of the Canadian General Electric Company, has been appointed manager of the General Engineering Company, of Toronto.

Mr. G. A. Powell, assistant manager of the Packard Electric Company, of St. Catharines, is about to sever his connection with that company, to assume the management of the Hamilton Electric Supply & Construction Company.

After an illness of three weeks, Mr. R. J. Holley, of Weston, died a fortnight ago, in his 48th year. Mr. Holley was chief engineer of the electric light plant in Weston, where he had lived the greater part of his life.

Mr. A. E. Payne, who has represented the Packard Electric Company, of St. Catherines, and Mr. R. E. T. Pringle, of Montreal, for the past year and one-half through Ontario and Quebec, has served his connection with these firms.

Mr. E. E. Cary, manager of the Packard Electric Co., St. Catharines, Ont., has recently returned from a trip to Great Britain and the Continent. He reports having had a good time, and feels reinvigorated by the relaxation from business.

Mr. Warren Y. Soper, of Ahearn & Soper, Ottawa, recently returned from a visit to the works of the Westinghouse Electric Company at Pittsburg, Pa. Mr. Soper says that the works of this company are over half a mile in length, employing 6,600 hands. Among the large machines now under construction are six generators of 8,000 h.p. each, for the Manhattan Elevated Railway, of New York. The new machines for the Ottawa Electric Company are being manufactured by the Westinghouse Company, for whom Messrs. Ahearn & Soper are the Canadian representatives.

Mr. R. R. Wiley, E. E., has recently joined the staff of the Packard Electric Company, of St. Catharines, as meter expert. Mr. Wiley, since his graduation at Wisconsin in 1898, has been associated with Mr. Shecffer, of the Diamond Meter Company, and Mr. Duncan, the well known meter inventor now attached to the staff of the meter department of the Packard Company, and his services will be at the command of their customers.

SPARKS.

The Canadian General Electric Company are installing a 75 kilowatt alternator for Dr. A. Groves, of Fergus, Ont.

The Farmers' Co-Operative Packing Company, Limited, Brantford, has purchased from the Royal Electric Company, Montreal, a direct current plant to light its packing houses at Brantford.

The Hull Electric Company, Aylmer, Que., have recently purchased from the Canadian General Electric Company another 250 k.w. monocyclic alternator, with exciter and panel complete.

The first new 2,000 k.w. generator for the Cataract Power Company, of Hamilton, was shipped from the shops of the Royal Electric Company, Montreal, on the 25th of July. It occupied four cars.

The Canadian General Electric Company have just received an order from the British Columbia Electric Company, Vancouver, for 165 of their standard type "H" transformers, aggregating in capacity a total of 6,500 lights.

The Electrical Construction Company, of London, Limited, have received an order from the Blind River Lumber Company, Blind River, Ont., for the supply of a 150 light multipolar dynamo for their mills, also for the complete wiring of their mills and lumber docks.

There has recently been formed the Hamilton Electric Supply & Construction Company, which will operate in Hamilton in the near future. Construction work there has already been commenced. The company is capitalized at $25,000, of which $15,000 is paid up. They will have the exclusive agency of the Packard Company's and the C. P. Company's electrical specialties for the city of Hamilton and the districts through which the lines of the Cataract Power Company run. They will carry a large stock of electrical supplies, including incandescent lamps, fixtures and bell material, etc., and will be in a position to cater to both the wholesale and retail trade as well as to the ordinary contractor. Mr. E. E. Cary, manager of the Packard Electric Company, of St Catharines, is president of the company. Mr. G. A. Powell secretary treasurer, and Mr. Norman H. Henderson general superintendent of construction work. The management will be in the hands of Mr. G. A. Powell.

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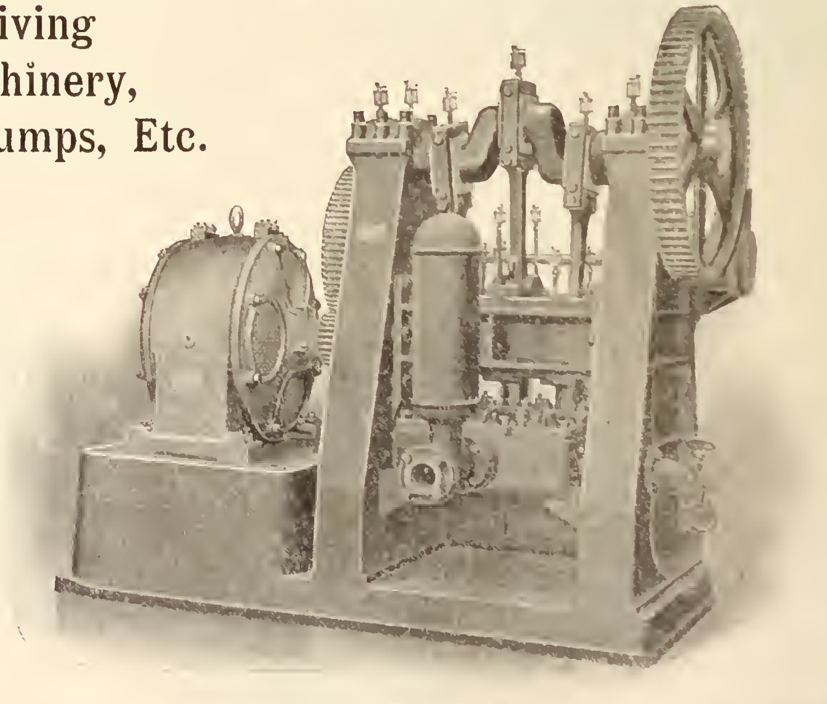

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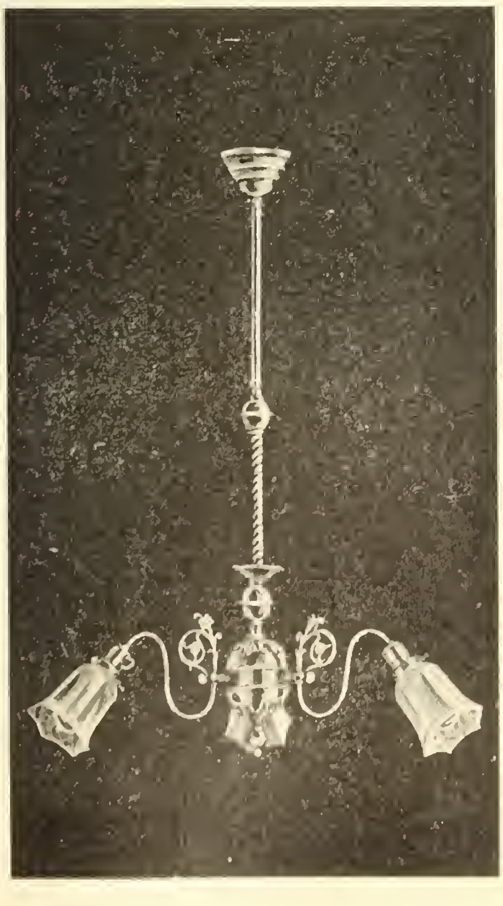

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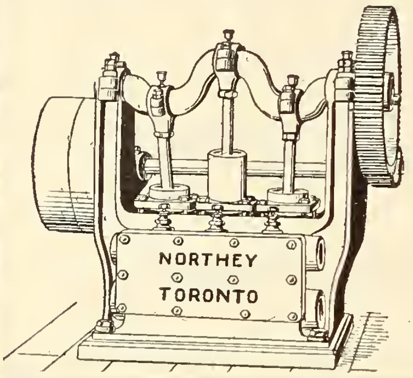

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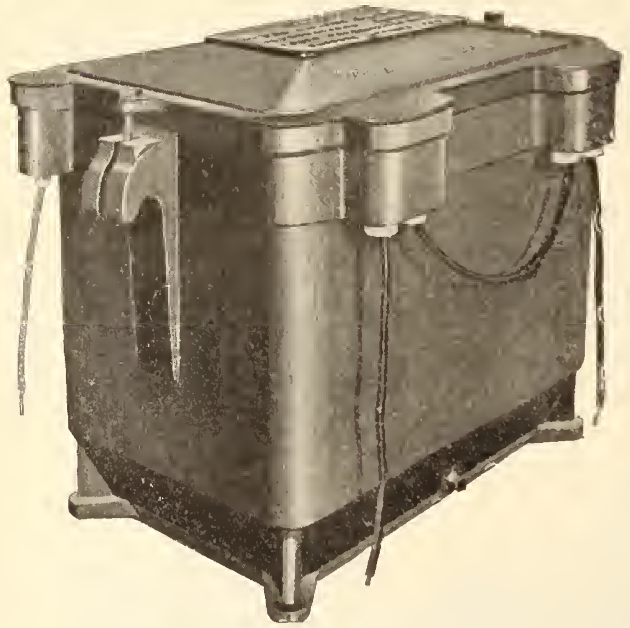

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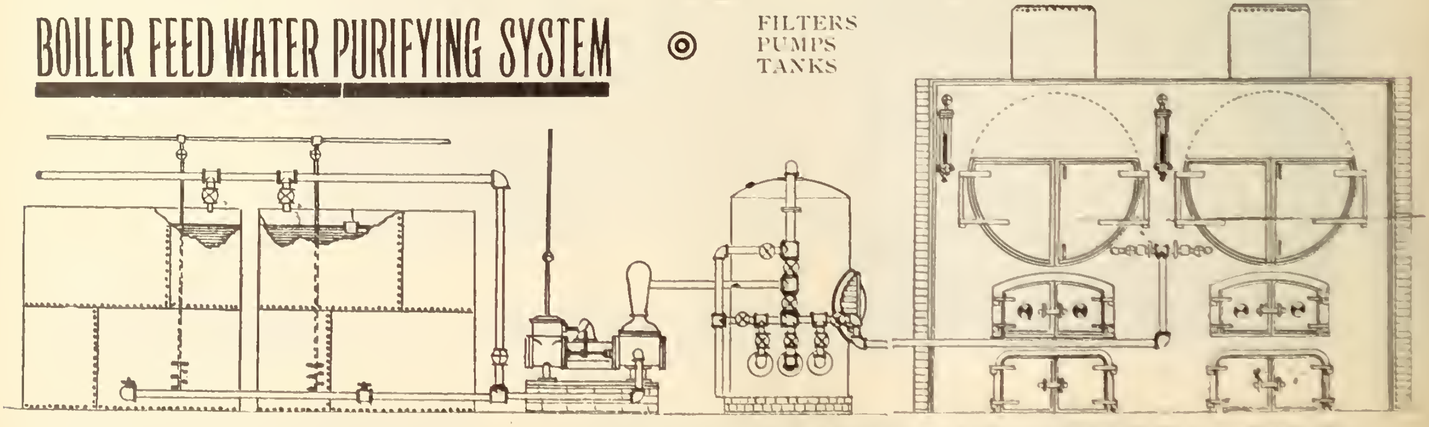

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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. X. AUGUST, 1900 No. 8.

Canadian Electrical Association Convention

KINGSTON THE MEETING PLACE

THE great conflagration which occurred in the cities of Ottawa and Hull a few months ago has been responsible for the selection of the city of Kingston as the meeting place of the tenth annual convention of the Canadian Electrical Association, likewise for a change in the date thereof to August 29th, 30th and 31st. These changes, however, are not likely to affect in the slightest degree the success of the convention, which gives promise of being well attended and of an interesting character. A new departure will be an exhibit of electrical apparatus. It is understood that a number of the manufacturing and supply firms are expected to exhibit, and a unique and attractive display may be looked for. Among the social features will be the usual banquet, excursions, and a military tattoo. The business of the convention will close at noon of Friday, 31st inst. Illustrations and particulars of some of the electrical and other features in and around the city of Kingston, together with the programme of business and social features, will be found on this and following pages.

CONVENTION HEADQUARTERS—CITY HALL, KINGSTON.

THE CITY OF KINGSTON.

Briefly sketching the history of this city, which will be pleased to entertain the members of the Canadian Electrical Association; Kingston under the name of Fort Cataraqui was established by the French, under Governor de Courcelles (1672) as a fur trading post. Count Frontenac's strong rule produced the massive stone fort called after himself. Ultimately seized and occupied by both the French and English, it was destroyed by the latter under Colonel Bradstreet in 1878. Rebuilt as Fort Henry, that historical structure still frowns upon all enemies to the city. The seat of government in 1841, Kingston grew in importance.

The general appearance of the city is that of solidity and antique beauty. Extensive industries of shipbuilding, grain transhipment and the weaving of cotton and woollen goods are carried on. In connection with the latter two, and numerous other local industries, electricity is used as the lighting, and largely as the power medium.

On entering the harbor of Kingston, the "Sandhurst" or west point of Canada, one is struck with the beautiful natural situation of the city. Nestling at the foot of Lake Ontario, at the head of the St. Lawrence, and at the mouth of the Rideau canal, it has a splendid situation and an excellent harbor. To the west stretches the village of Portsmouth, distinguished for its shipbuilding and trans-shipping industries, where are also the Rockwood Asylum and the Kingston Penitentiary. Fronting the city are the military college, the massive grey stone masonry of Fort Henry, numerous martello towers objects now of historical interest. Imposing public buildings, churches, and artistically designed private dwellings, all display the prevalent limestone architecture which has secured for this military town the name of the "Limestone City." Kingston is well laid out and adorned by massive buildings.

Visitors should not fail to see the city hall, one of the oldest but at the same time best designed municipal buildings in Canada, the court house with its pillars and dome in Grecian style, the post office, custom house, St. Mary's cathedral—the tower of which, situated in the heart of the city and a masterly work of

Gothic architectural skill, can be seen at a great distance. St. George's cathedral, recently rebuilt and decorated in the interior with a magnificence of design and finish, unrivalled before in the history of local architecture, will well repay a visit. In the artificial lighting of the interior of this church, Mr. I. H. Breck, the Princess street electrician, displayed great skill and judgment. Delegates visiting the church will not fail to admire the elegance of design in the fixtures and the specially designed corrugated reflectors in the altar. The high shapely dome is supplied with 54 lights of the Edison base and 16 candle power. Shades are set in porcelain. The switchboard, of polished white marble, has eight separate switches. The fixtures and controlling power of the 150 lights are considered to be the best work in electrical illumination yet done in the city.

Kingston's colleges are of continental repute. They are Queen's University, Royal Military College, Royal Medical College, School of Art, Business College, Congregation de Notre Dame, etc. Each of these, the magnificently equipped General Hospital and Hotel Dieu, and the public school building are well worth a visit. All the institutions named have all modern conveniences of electricity, such as lighting, communication and heating.

The City of Kingston.

Running in a northerly direction are Princess, Brock, and, slightly more to the east, Barrie streets, while King and Ontario streets stretch parallel to the water front and from east to west.

The city buildings, where the coming convention will be held, overlook the harbor, command a splendid view of Fort Henry and Barriefield, and are within a few yards of both the Grand Trunk and the Kingston & Pembroke Railway depots.

THE COURT HOUSE.

In architecture the Court House most resembles the City Hall, and built of limestone it has the same large front pillars, the same massive proportions, and is about of the same dimensions. In the building are the court rooms, county council chambers and offices, judges' chambers, sheriff's offices, etc. On an elevation, the building commands a fine view of the cricket field, city park, and some very handsome residences. It is in front of this building that the Sir George A. Kirkpatrick memorial fountain will be placed. Street cars pass close by, so every delegate should see the building.

SOME PLACES OF BUSINESS.

The three storey building of the wholesale dry goods firm of Macnee & Minnes is one of the largest, finest, and handsomest stores in Kingston. Made of solid stone, the massive structure is the most conspicuous in the city. The business is over half a century old, and its age is exceeded by its solidity and sound financial basis. The firm exports wholesale every description of dry goods to all parts of the world. Mayor Minnes is a member of the firm. On the corner of Bagot and Princess streets the building presents a most imposing appearance. The delegates will receive a hearty welcome from the proprietors and staff of fifty hands. This old wholesale establishments, one of the city's landmarks, is well worth a call.

Wormwith & Co. is one of the oldest, most noted and prominent firms in the piano industry, which has for a third of a century enjoyed the highest reputation. The business was established in 1862, and the firm soon became known as makers of distinction, and almost from the start their instruments have been regarded as among the most reliable made. Their present factory is situated on the corner of Princess and Ontario streets, and is one of largest buildings in the city, it being 166 by 66 feet, of cut stone, four storeys and basement, with a 60 by 60 foot building in the rear, and is among the most extensive and best equipped factories in the Dominion, having a capacity for turning out 000 pianos per year. Formerly the firm used electric motors, but increase of business has demanded the use of steam for motive power.

THE MAYOR OF KINGSTON.

In this number will be found a portrait of Mayor Minnes, who has served four years as alderman and is now chief magistrate of the city. Connected with Macnee & Minnes, wholesale dry goods firm, he and his father before him have long been identified with the soundest and most substantial business enterprises of the city. Although only 31 years of age, Mr. Minnes is a friend of all and an idol with the laboring classes. The friendly interest that he takes in all the city's functions, be it a fair, a celebration, or a convention, is now being exerted to entertain in a fitting manner the Canadian Electrical Association delegates.

THE FIRE BRIGADE.

Chief Youlden, assistant chief Elmer, and engineer Miller, with the other thirteen men of the fire brigade, will be glad to show the delegates around the two well equipped city stations. With all modern appliances, 3,200 feet of hose and a system of alarm including 26 boxes, most of them made by Anderson, of Toronto, the brigade does first-class work. In connection with the alarm system 15 miles of galvanized wire (fast giving place to the more modern and enduring covered wire), are Manual switchboards, one in the Ontario street, and one in the Brock street stations. Four mechanical and eight electrical gongs are placed in the stations, firemen's homes, police headquarters, etc. The system is run by by a 102 cup gravity battery. Electrical devices as to alarms, closing doors, etc., are in vogue in both fire stations. Anderson, of Toronto, laid a large part of the system. The Bell Telephone Co., Montreal, turned out four of the alarm boxes. The Dominion Government has an arrangement with the Department as to protection of the Royal Military College.

THE RAILWAY STATIONS.

In front of the city hall is situated the Kingston and Pembroke Railway station. The handsome building, 65 x 24 feet, built of cut limestone, coursed ashlar style, is two storys high. It has a mansard roof covered with slate, and is ornamented with pretty iron designs. Finished in natural woods, with plate glass windows, and transoms of beautifully colored glass, and containing offices, waiting rooms, lavatory and electric lights, the interior is handsome in appearance. The building cost $12,000. In the rear of the station is the two story freight shed, 100 x 34 feet. It is constructed of wood and iron, orial windows projecting from the upper story. Electric lights, appliances, gongs, a telegraphic plant, offices, and a library for employees, are some of the features. The cost was $6,000.

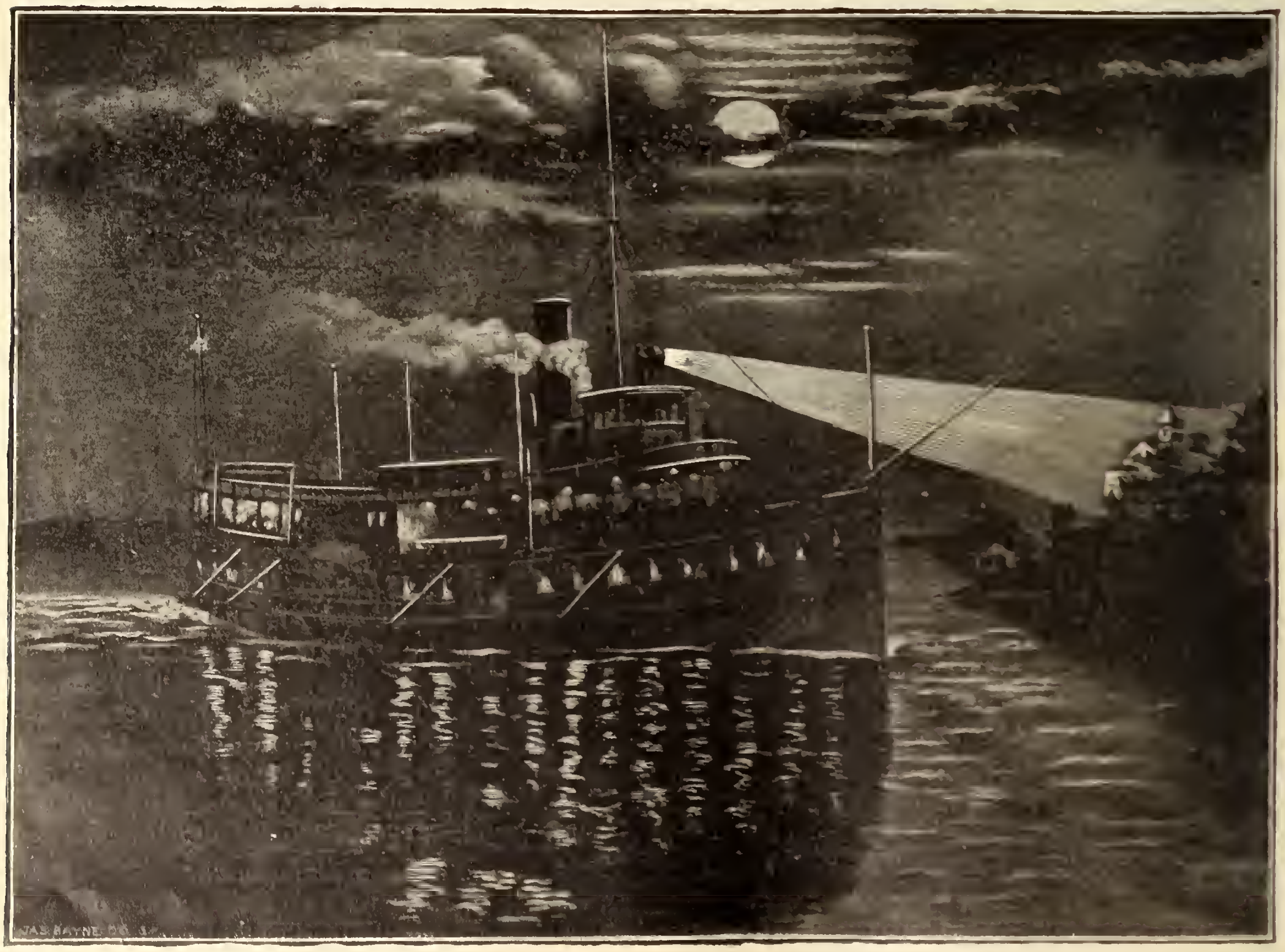
The G. T. R. outer station, two miles from the city is a one story building, thoroughly equipped with offices, waiting rooms, electrical devices, telephone and telegraphic communication, etc. The city depot at the foot of Johnston street, and a few minutes walk from the Hotel Frontenac, is built of brick and stone. It is a two story building, bright, large, and well ventilated and illuminated. The waiting rooms and offices are neatly furnished. Electric cars pass the door, and opposite the station is Swift's wharf where the palatial steamers of the Richelieu and Ontario Navigation Co. and also the Bay of Quinte Steamboat Co. touch.

ELECTRIC STREET RAILWAY.

The street railway system of Kingston, extending to Williamsville on the north, Portsmouth, passing directly in front of the asylum and penitentiary, on the east, and a branch line connecting with the G. T. R.

KINGSTON HARBOR AND PART OF THE CITY FROM THE TOP OF ONE OF THE GRAIN ELEVATORS.

A View from Smoke Island, in Canadian Channel on the New "Island Wanderer.


JAS. BAYNE CO.

Steamer St. Lawrence on Her Searchlight Excursion Among the Thousand Islands.

depot on the west, is one of the most modernly equipped in Canada. The company has a capital stock of $200,000. The road is well laid out over 12 miles with a 4 ft. 8½ in. gauge track, made of "T" rails, 55 to 65 lbs. to the yard. The current is supplied by the Kingston Light, Heat & Power Company from the power house on Queen street to the 19 handsome motor cars of modern upholstery and furnishing.

Skirting the lake front, the eastern portion of the line passes several city parks, many handsome private dwellings, churches, public schools, etc., on King, Ontario, Barrie and Union streets; and running for two miles passes Portsmouth to enter Lake Ontario park, Kingston's "Hanlan's Point," where 40 acres fronting the lake front have been converted into an ideal park, with horse track, diamond, bicycle track, etc., in connection and in the best of condition. The asylum and penitentiary nearby are interesting places the delegates will be requested to visit.

The other two branches—the belt line and that running two miles out to the depot—pass some fine buildings, parks, and natural scenery, which Kingstonians claim are unrivalled.

The officers of the company are : Ira A. Breck, president ; B.W. Folger, vice-president and manager ; J.W. Bowden, secretary ; H. C. Nickle, superintendent ; J. Halliday, electrician. One of the views shown gives a good picture of the street cars, showing six of them leaving the car barns on King street at 7 o'clock in the morning.

Kingston Penitentiary.

ELECTRICAL PLANT AT THE PENITENTIARY.

No doubt all the delegates will make it a point to visit the penitentiary, where upwards of 600 prisoners are confined, amongst the number the celebrated trio of dynamiters, Walsh, Nolan and Dullman, whom the government are so zealously guarding. The penitentiary has an electrical plant, built by W. A. Johnston, of Toronto, consisting of two 250 light Ball machines. The offices, avenues, guards' quarters, etc., in the big enclosure are all supplied with lights, and one incandescent is placed in each prisoner's cell. Fronting the huge main gateway, near the observation towers, and in the interior yard, are several powerful arc lights, all lit up every night. Electrical communication, bells, gongs, etc., are in vogue through all parts of the prison. The current is carried to the opposite side of the road to light up the interior and grounds of Warden Platt's palatial residence and magnificent grounds. Wm. Derry is chief engineer, and Charles Bailey electrician.

At Rockwood Asylum a small Edison bi-polar machine supplies 60 lights to illuminate the music hall. The matter of installing a large and modern plant to light the whole building is under consideration. The street cars pass both penitentiary and asylum.

Car Barns of the Kingston, Pembroke and Cataraqui Electric Railway Company.

ELECTRICITY IN QUEEN'S UNIVERSITY.

At Queen's University the current is supplied to the general buildings by the Kingston Light, Heat & Power Co. It is used in running two motors in the mechanical laboratory for the purpose of driving the various pieces of machinery, and one motor in the Carruthers Science Hall for purposes of ventilation, in decomposing water for the purpose of obtaining oxygen and hydrogen for the chemical laboratories, in exciting electro-magnets in the magnetic separator in the mining mill, and in running a number of electric lanterns, of which there is one in connection with nearly every department, and as the alternating current is not adapted to lantern work, on account of its objectionable singing, the direct current is the only one employed.

Preparations are at present being made for a very much more extended use of electricity than at present ; for in addition to the present use it is proposed to intro-

Queen's University, Kingston.

duce a complete system of fan ventilation in each building, both old and new, and to drive the fans of each building by separate motors.

Mr. M. H. Folger,
President Thousand Island Steamboat Co.

Mr. F. A. Folger, Sr.
Manager Kingston Light, Heat and Power Co.

Mr. B. W. Folger, Sr.
Manager K.P. and C. Electric Railway Co.

In connection with this the university will erect a central heating and power station within its own grounds, from which heat, power and light will be distributed to the buildings as required. It will be feasible then to light not only the buildings, but also the campus by electricity when required. To accomplish all this a considerable number of dynamos and motors, as well as other electrical appliances, will be required. And as Queen's, although well grounded in the public confidence, has no liberal millionaire at her back, she has to go slowly, much more slowly than her progressive spirit desires, and she will always be thankful for any aid extended to her in carrying out her proposed and much required extensions and improvements. Prof. N. F. Dupius, one of the best known mathematicians in America, has long been Dean of the Faculty of Practical Science at Queen's.

KINGSTON LIGHT, HEAT AND POWER COMPANY

The Kingston Light, Heat & Power Company's plant is located on the corner of King and Queen streets. The power house is of stone and brick, 40 feet by 80 feet, with boiler room 32 by 49 feet. The water supply for the condensers and boilers is taken from the foot of Queen street, which is about 300 feet distant. In the boiler room are five tubular boilers 66 inches by 14 feet, with 106 three inch tubes each, one upright engine and fan outfit for forced draught, and one duplex pump for hoisting elevator, &c. The fan outfit is used very seldom, as a well constructed brick chimney 5 feet in diameter by 60 feet high supplies ample draught. Two tons of hard to one of soft coal screenings are used for fuel.

Power House, Kingston Light, Heat & Power Co.

Switchboard, Kingston Light, Heat & Power Co.

In the engine and dynamo room are two tandem compound condensing Corliss engines of 350 horse power each, built by Messrs. John Inglis & Son, Toronto; one Northey condenser and one Northey tandem compound feed pump for supplying the boilers; one upright brass tubular heater made by the Kingston Foundry Company. The engines are belted direct to a main line shaft, from which are driven two No. 20 Edison dynamos coupled up for the Edison three wire system for central distribution; one No. 60 T & H 2,000 volt alternator for the long distance lighting; three 50 light American arc machines for supplying street lighting; one 200 k.w. 500 volt multipolar street railway generator, manufactured by the Canadian General Electric Company, and one 100 k.w. 500 volt multipolar street railway generator manufactured by the same company. Power is supplied from these machines for the operation of the street railway system. In the front of the building is one of the best equipped switch-boards in Canada, made of slate slabs one inch thick by 5 feet square. It stands 10 feet high by 25 feet long, with all the necessary instruments that are required to duplicate the generating plant, which was the original design of the plant.

The plant is now at times taxed to its full capacity, and the company are preparing for extensions to meet the fall business. There are 8,000 sixteen candle power lights installed and 115 arc lamps for street lighting.

Annexed to this building is the gas plant, which has just gone through a renovation and is now one of the most up to date plants in Canada. The electric light and gas business are one of the many lines of business which Messrs. Folger Brothers are interested in, and is under the management of Mr. F. A. Folger, sr.; secretary and treasurer, E. Moore; superintendent of electrical department, F. Simmons.

Mr. Jas. A. Minnes, Mayor of Kingston.

THE BELL TELEPHONE EXCHANGE.

Amongst other places of interest to the delegates attending the Convention at Kingston, the exchange of the Bell Telephone Company will be visited with pleasure.

Like other branches of the art, telephony has been brought to such perfection that one hardly recognizes in the modern exchange any signs of the business having once been crude, irritating and unsatisfactory.

Kingston is a fair sample of the progress made during the past twenty years. This exchange was started in 1880 with about thirty subscribers; most of the lines were on house-tops, and "Gilleland" switches were the standard equipment of that day. There were no long distance lines. The growth was very slow, only reaching 175 subscribers in 1885. Since that date three complete changes in switching equipment have been made, long distance lines have been built, and Kingston is to-day one of the most progressive telephone cities in Canada. The local subscribers number 540, while the splendid service furnished has induced merchants and the management of large marine interests to liberally patronize the long distance lines. The exchange is a model for convenience and up-to-date equipment. The operating room has been specially designed for perfect light, ventilation and convenience. The distributing arrangements, arresters, power generators, etc., are of the most modern type, and everything about the place has an unmistakable business air about it.

The exchange has since 1885 been in charge of Mr. A. T. Smith, now district superintendent of the Ontario department, with headquarters at Toronto, whose thorough knowledge of the details of the business is well known to the members of the Association. He has been succeeded by Mr. H. W. Snelling, of Montreal, who reports business as flourishing and repudiates that old "chestnut" that Kingston is "slow."

A visit to the exchange, where all are welcome, will well repay the delegates.

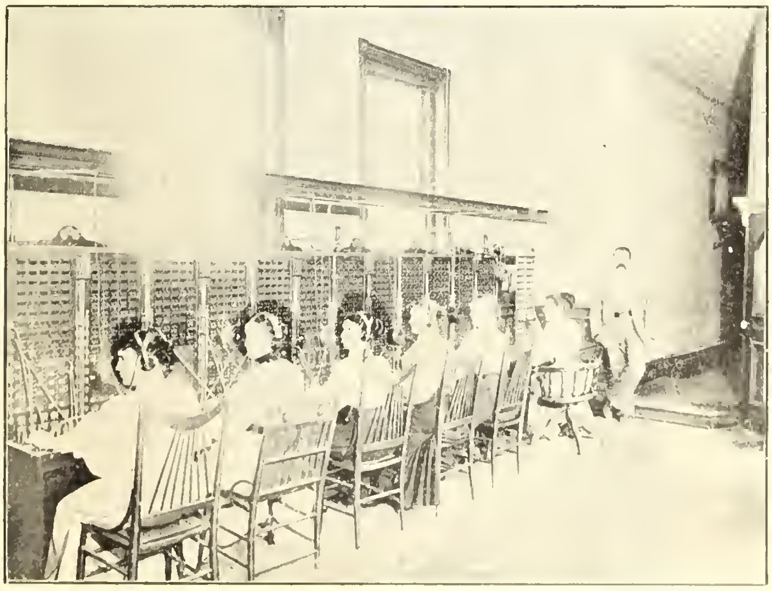
FURNISHED WITH ELECTRIC PLANTS.

The Montreal Transportation Company's mammoth elevator at the foot of Barrack street is well worth a visit. The plant is equipped with a 250 light multipolar dynamo of the Canadian General Electric Company's type, which is directly coupled to an Ideal engine. Numerous powerful arc lights, some of them movable, illuminate the surroundings very brightly and make the loading and unloading of thousands of bushels of grain at night time an easy matter. This company frequently trans-ships as much as 250,000 bushels of grain in 24 hours.

The Kingston Hosiery Company is another industry that has a plant of its own. It is equipped with a 500 light multipolar Walker type dynamo, manufactured by the United Electric Company, of Toronto, and coupled to an Robb-Armstrong engine. Knitting machines, etc., are driven by motive power.

The Royal Military College has a small plant furnished with all the necessary appliances that are required for technical purposes, and for instruction in classes in connection with military engineering, electrical engineering, etc.

The Dominion Cotton Company last spring installed in their local mill an excellent plant, including one 650 dynamo made by Siemens & Halske. The current is direct from a coupled dynamo. The engine is a Robb one. The plant was installed by the Royal Electric Company, of Montreal.



Interior of Bell Telephone Exchange, Kingston.

ELECTRIC SEARCH LIGHTS.

Kingston is surrounded with the elements of the beautiful. From the "Limestone City" to Brockville the scenery is most magnificent. Between the points mentioned seventeen hundred isles the renowned thousand islands all sizes, from a barren rock to large islands covered with the richest foliage, and containing some of their palatial summer residences, rise from the bosom of the St. Lawrence. The well equipped steamers of the White squadron thread their way through the labyrinthian channels, disclosing little islets, isles, artificial devices, etc., of the most delicate and varied type of loveliness. It will be the privilege of the delegates to view some of these islands under the searching beams of the powerful searchlights of one of the steamers referred to. This line of boats, conducted by the Folger Bros., are all equipped with electric plants. The electrical plants of the steamers St. Lawrence and Empire State each consist of a Westinghouse engine, C and C dynamos of 500 lights capacity, and searchlights made by the General Electric Company, Schnectady, and of 2,000,000 candle power. The steamer America has an Edison dynamo of 500 lights capacity, and searchlight of 2,000,000 candle power made by the United Electric Company, of Toronto. The New Island Wonder, the New York, the Hero, and other steamers, all have powerful searchlights and are beautifully illuminated with incandescent lights. The searchlight trip down the River St. Lawrence is something no delegate should miss. On the return trip the steamer will pass near Wolfe Island, Garden Island, and all along the harbor front, which the powerful searchlight will illuminate brilliantly.

MR. I. A. BRECK,
President Kingston, Pembroke and Cataraqui Electric Railway Company.

MR. W. F. SIMMONS,
Superintendent Kingston Light, Heat & Power Company.

CITY ELECTRICIANS.

A word might be said regarding those engaged in the electrical business. Mr. W. F. Simmons commenced his electrical career in 1888 as errand boy with the then Kingston Electric Light Company. By his close observation he was soon promoted to engineer and dynamo tender, under the superintendence of Mr. J. M. Campbell. In a very short time the company found it necessary to enlarge their plant and add an incandescent plant. At this change Mr. Simmons was promoted to foreman of construction. This position he held until the amalgamation of the electric light and gas companies in 1890, under the name of the Kingston Light, Heat & Power Company. At this stage Mr J. M. Campbell resigned to accept a position with the Canadian General Electric Company as electrical engineer, and Mr. Simmons was advanced to the position of superintendent. This position he has held for ten years, and has certainly proved to be a thoroughly practical electrical and steam engineer.

MR. J. HALLIDAY,
Electrician Kingston, Pembroke and Cataraqui Electric Railway.

Mr. I. H. Breck commenced business in 1897 at 339 King street. He remained here until the year 1899, when he found it necessary, owing to increased business, to move to the large and commodious store that he now occupies. In his place of business, 70 Princess street, will be found everything of interest to an electrician, all of the latest things in the electrical lines, etc., for being an electrician himself he knows exactly what and where to buy. His workmen are skilled electricians who have spent years at their trade, and the several large buildings he has wired speaks well of his ability and serves to show that he is competent to undertake any work entrusted to him. His work in St. George's Cathedral, at Kingston, is a good

MR. HUGH C. NICKLE,
Superintendent Kingsten, Pembroke and Cataraqui Electric Railway

example of his workmanship. He makes a specialty of all kinds of electric wiring and motor work, and has full and complete facilities for testing and repairing. Mr. Breck learned his trade with the Kingston Light, Heat & Power Co., and studied the several branches of the work there, and has now a thorough knowledge of the electrical business. Mr. Breck's men are under the supervision of Mr. W. S. Raymond, who is an expert electrician.

Mr. R. Boyd, electrician, at his store, 327 Princess street, keeps always on hand dynamos, motors, annunciators, gongs, bell wire, electric lights, etc. He also learned the business with the Kingston Light, Heat & Power Co., and has met with considerable success. He makes a specialty of window electric wiring and illuminating.

Mr. George R. Tomlinson keeps a supply of all kinds of electrical goods at his well equipped store at 258 Princess street. He makes a specialty of window illuminations.

NOTES ON THE CONVENTION.

Mr. I. H. Breck will have constructed over the platform in letters of incandescent lights the words "Welcome C. E. A." They will be set on a background designed as a maple leaf, emblematic of the Association, and will be brilliantly illuminated with colored lights.

In connection with the proposed exhibit of electrical apparatus, it is learned that the Packard Electric Company, of St. Catharines, have secured 900 square feet of space, that the Royal Electric Company will make an exhibit, and that the Western Electric Co., of Chicago, and the Adams-Bagnall Co., of Cleveland, will each make a display of enclosed arc lamps.

Kingston owns its waterworks, the pump house being on Ontario street near convention headquarters. All delegates should inspect it, as the system is an excellent one, and most of it but lately built.

The delegates will mostly register at the Hotel Frontenac, the largest and best equipped in the city. The genial proprietor, Mr. Thomas Crate, so well known to the travelling public as a first-class hotel keeper, will look well after the wants of the members of the Association. The "Frontenac" is on Ontario street, about 100 yards from the City Hall. It is in sight of both railway stations, and near the city wharves. The street cars pass directly in front of the hotel.

Mr. I. H. Breck, Electrician.

Electrical time detectors manufactured by the Cleveland, Ohio, Electrical Co., are used at the Cotton Mill, Anglin's Wood Yard, Locomotive Works, Kingston Foundry and by the Montreal Transportation Company.

There are three well equipped telegraph offices in Kingston. Mr. Wm. Bamfield is general manager of the North American Telegraph Co.'s branch, Mr. R. J. Wilson conducts the C. P. R. Telegraph Co.'s local office, and Mr. James Kearns has control of the G. N. W. Telegraph Co.'s city business. All three offices are on Clarence street.

Several of the illustrations shown were obtained through the courtesy of Mr. Breck. In addition to his electrical knowledge, he is an excellent amateur photographer.

Mr. R. Boyd, Electrician.

PROGRAMME.

WEDNESDAY, AUGUST 29th.—Meeting of Executive Committee at Hotel Frontenac, 9 a.m. sharp. Opening of Convention at the Hall (City Hall Chambers or Hotel) 10 a.m. Order of business: (1) Welcome by Mayor of Kingston; (2) President's Annual Address; (3) Reading of Minutes of last Meeting; (4) Report of Secretary-Treasurer; (5) Reports of Standing Committees; (6) Appointment of Nominating Committee; (7) Reading and Discussion of Papers; (8) General Business. (To be continued into the Afternoon Session which will begin at 2.15 p.m.)

THURSDAY, AUGUST 30th—10 a. m.—Consideration of President's Address and Reports of Secretary-Treasurer and Standing Committees; Election of Standing Committees; Reading and Discussion of Papers; General Business. (To be continued into Afternoon Session—2.15 p.m.)

FRIDAY, AUGUST 31st.—10 a. m.—Selection of Place of Next Meeting and Approximate Date; Election of Officers and Executive Committee; General Business.

SOCIAL FEATURES.

WEDNESDAY, AUGUST 29th.—7.30 p. m.—Complimentary search-light excursion among the Thousand Islands, tendered by the Mayor and citizens of Kingston.

THURSDAY, AUGUST 30th.—9.30 p. m.—Annual Banquet at Hotel Frontenac.

FRIDAY, AUGUST 31st.—Excursions will be arranged for the afternoon, and at 8 p.m. a grand spectacular band concert by the famous 14th Regimental Band, introducing an electrical musical fantasy of the Battle of Paardeberg, with electrical effects and fireworks.

LIST AND ORDER OF PAPERS.

1. "Use of Dynamo and Storage Battery in Telegraph Offices."
   Mr. W. J. Camp, C.P.R. Telegraph Co., Montreal.
2. "Utilizing the Available Central Station Capacity."
   Prof. R.B. Owens, McGill University, Montreal.
3. "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps."
   Mr. F. H. Leonard, jr., Montreal.
4. "Conditions Affecting the Wave Form of Alternators."
   Prof. L.A. Herdt, McGill University, Montreal.
5. "Rotary Converters."
   Mr. A. Gordon Grier and Mr. J.C. Hyde, Montreal.
6. "Railway Subject, Giving Several Curves Showing up the Average Power During a Day, and Maximum and Minimum Requirements for Power Called For on the Quebec System."
   Mr. Blair, Quebec Railway & Lighting Co., Quebec.

In order to give closer attention to their Canadian business, The Edwin C. Lewis Company, electrical contractors, of Boston, have established an office in the Temple Building, Montreal, which will be under the management of Mr. Philip Lahee, who has been associated with them for the past ten years.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

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Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later tban the 28th day of the month immediately preceding date of issue. Changes in advertisements will he made whenever desired, without cost to the advertiser, hut to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 26th day of tbe month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will he mailed to subscrihers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted hy currency, registered letter, or postal order payahle to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated hy the subscriher, hut where no such understanding exists, will he continued until instructions to discontinue are received and all arrearages paid.

Subscrihers may have the mailing address changed as often as desired. When ordering change, always give the old as well as the new address.

The Publishers should he notified of the failure of subscrihers to receive their paper promptly and regularly.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

CANADIAN ELECTRICAL ASSOCIATION.

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ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

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How to Become an Electrician.

THE eagerness of young men to enter the electrical business shows no signs of abatement. The superintendent of one of the Canadian electrical manufacturing companies states that he receives on an average twenty applications per week from youths wishing to enter the factory as apprentices. These applications come from all parts of the country. Many of the applicants have a very indefinite idea of the work which they will be called on to perform. They seem to think that an electrical manufactory is a place where a large amount of experimental work is done. On entering, they find that most of the work is purely mechanical and by no means clean; that the experiments and tests which are made from time to time are for the first few years beyond their comprehension; that they are confined for many hours each day within doors, and are required to give close application to whatever work may be given them to perform. All this is contrary to their preconceived notions, and as a consequence many abandon the business and turn their attention to something else. In the opinion of the above-mentioned superintendent, the best preliminary training for the young man who wishes to work his way up in the electrical business is two or three years' experience in a machine shop.

Canadian Electrical Association.

THE Executive Committee, at a meeting held a fortnight ago, decided to accept the cordial invitation extended by the city council and electrical companies of Kingston to hold the annual convention this year in the Limestone City. This decision meets with the approval of the members and friends of the Association in Ottawa, which was to have been the place of meeting. It is felt that, owing to the disorganized condition of affairs in that city at present, due to the recent disastrous fire, the convention could not conveniently be held there this year. As will be observed by the illustrations and descriptions appearing in this number, Kingston is an interesting city. Situated in close proximity to the Thousand Islands, a locality famous the world over for its natural beauties as well as the beautiful and unique character of the summer residences erected upon the islands, the surroundings as well as the city itself will repay a visit. Kingston's location, midway between Montreal and Toronto, and conveniently reached by rail or water from all points of the compass, adds to its suitability as the place of meeting, and should assist to ensure a large attendance.

The programme prepared for this convention is one of the most interesting and instructive that has ever been placed before the members. It is printed in detail in another column. The papers cover a wide range of subjects relating to various departments of electrical work. The standing of the authors is a guarantee that the matter of these papers will be interesting and instructive. This being the case, the discussions should be full and profitable. A new feature will be introduced this year by providing, without charge, by courtesy of the city authorities and the Kingston Light, Heat and Power Co., space, current and labor to manufacturers who may wish to install exhibits of electrical appliances. A cordial invitation is given to manufacturers and dealers in electrical supplies to avail themselves of this offer. The Kingston Street Railway Co. has offered to carry free, all persons wearing the Association badge and to supply extra cars for special trips. The city council have appropriated the sum of $200 for the entertainment of the visitors, and have appointed a committee to assist in making the necessary local arrangements. The city council chamber has been placed at the disposal of the Association for the convention, and space in the City Hall for exhibits. An afternoon and evening trip among the Thousand Islands will form a delightful feature of the programme of entertainment.

A large turnout of the members of the Association is looked for at this convention. A cordial invitation is also extended to persons connected with any branch of the electrical industry to become members and take part in the approaching convention. During the last two years the Association has done valuable service in protecting the interests of electric lighting companies. Such of these companies as are not already represented on the membership of the Association should now make make connection with it, give it the benefit of their support and ideas and assist to place it in a position to exercise still greater influence in behalf of electrical interests.

The Operation of Synchronous Motors.

A superficial comparison between the action of the synchronous and of the direct current motor with which we are all so familiar generally leads to the view that they are direct opposites. In the effects produced in actual operation in many respects they are, but in the principles involved when allowances are made for the different actions of direct and alternating currents, the results attained are seen to be such as might have been expected. The practical operation of the direct current motor shows that it possesses high starting torque’ that it may be run at any desired speed, and that its current consumption varies with its power output. On the other hand, the synchronous motor develops small starting torque, it runs at an absolutely unvarying speed, which is fixed by the generator from which it is driven, and can exert but little turning effect except at that fixed speed, and its output in power is frequently not commensurate with the current input. For these reasons, where variable speed with a large torque is required, the direct current motor is the most suitable, while if it be desired to have an absolutely uniform speed, the synchronous motor holds the field. These differences in action are due primarily to the pulsating character of the current supplied to the synchronous motor as distinguished from the pulseless direct current operating the direct current motor. The results are that while in the direct current motor there are two E.M.Fs., the impressed and counter E.M.F., in the other there are three, the impressed, counter and reactance E.M.Fs. In the first case the impressed and counter E.M.Fs. act in opposite directions ; in the second they may or may not be directly opposite. A rise of voltage in the first case means increased speed, in the second no increase of speed, but an increase of wattless current.

Probably the most instructive method of comparing the actions of the two motors is to consider the action of two engine driven direct current dynamos feeding into the same set of bus bars, and two alternators under similar conditions. If in either case the driving belt be thrown off one machine, it becomes a motor driven from the other. In the case of the direct current machine the speed drops somewhat until the counter E.M.F. is so reduced that enough current enters the motor to allow it to overcome its own friction, and if a load be placed upon it a further decrease of speed follows. In the case of the alternating dynamo, its speed being fixed as rigidly as if it were geared directly to the other alternator which is supplying current to the bus bars, in order that enough current may flow to operate it as a motor it drops back in phase behind the impressed E.M.F., but not enough to throw it out of synchronism, and as the load increases so does the angle of lag between the E.M.Fs. In case the load became excessive, say three or four hundred per cent. of full load, the motor would lose synchronism and immediately come to rest just as it would were it gear driven and the teeth of the gears stripped off. Considered in this way, the direct current motor adjusts its input to the load to be carried by change of speed, while the synchronous motor automatically adjusts the angles at which its three E.M.F. act so as to allow combined pressures to force enough current in phase with the active pressure to operate the load. In fact, the synchronous motor is in every respect an alternating dynamo and uses the same station equipment with the addition of some starting apparatus and a larger exciter. In operation some means of starting is employed, either a resistance or impedence to keep down the rush of current as in the direct current motor starter, or by using a compensator which is a transformer with a variable ratio of primary to secondary E.M.Fs., enabling the motor to start on a low voltage, which is then gradually increased up to the running pressure. The above apparatus is used where the motor is not required to start under full torque, but still to be self starting. By these means a starting torque of about 25% of full may be obtained with not much more than full load in amperes. Where the motor has not enough torque to start from rest without assistance, a starting motor or a friction clutch, or both, are used, the main motor is driven to synchronism, and when in phase opposition to the supply current it is thrown in as a motor.

In operation a few points may be noted as being peculiar to the synchronous machine. The speed is independent of the voltage applied, but the torque varies as the square of the voltage, so that the pressure of supply should be kept up at least to the rated volts of the motor, and preferably higher. Under proper conditions the motor may operate at five hundred per cent. over its rating before breaking out and coming to a stand still. Where the motor is self starting it should be noted that when starting the fields are subjected to the inductive action of the current flowing in the armature and become practically the high voltage side of a transformer, and while, of course, the field circuit is not closed under the condition of self starting, and no current can flow in them, the high voltage introduced by induction places a great stress on the insulation of the coils to ground. To obviate the danger of puncturing, the fields are generally arranged to be cut in several places by a switch which is opened when starting. Probably a better method is to use few turns on the field with a low voltage exciter giving large currents ; this method of avoiding the trouble depending, of course upon the fact that the voltage induced in the field coils is proportionate to the number of turns in the coils.

One of the most valuable properties of the synchronous motor is its ability to overcome the lagging currents on the lines of long transmissions, which is accomplished by raising or lowering the excitation. The reasons for this ability to operate in this manner will be seen when it is remembered that the impressed E.M.F. is dependent upon the generator, the counter E.M.F. upon the excitation of the motor, and the reactance E.M.F. upon the load. The first being thus fixed and the latter usually out of the control of the motor operator, leaves the counter E.M.F. available for regulating the lines. As this counter E.M.F. depends, just as in a dynamo, upon the speed and the excitation, and as the first in the case of the synchronous motor is fixed, a variation in the exciting current might be expected to produce various results depending upon that excitation, and this is found to be the case. If the exciting current be varied while the motor is running under steady load, it will be found that at one point the input of current to the motor terminals is a minimum, and that as the excitation is either raised or lowered within limits, the current required to operate the motor is increased.

As the heating of the motor is dependent upon the current taken, independent of whether this is useful or wattless, that point of excitation is usually selected which gives the lowest current reading of motor input. In some cases, however, where it is advisable to overcome the inductive drop in long lines, the excitation may be increased so that the counter E.M.F. becomes greater than the impressed, when the motor acts as a condenser, and gives leading currents to the lines. Where a load of induction motors at the end of a long line gives a large inductive drop owing to the wattless currents flowing, a large synchronous motor over excited will be found to help out the transmission by supplying leading current to counteract the wattless, but it must not be forgotten that as the capacity of the synchronous motor is limited by the currents, whether active or wattless, which flow in its windings, it cannot be called upon for help to the others if it be already loaded to its capacity by its own load. Fortunately for the type, when the excitation is set at any load so that the motor will operate with a power factor of one, or in other words consume the least current for that particular load, any change of load will not be found to affect the required excitation quality. In other words, the excitation once set will be suitable, generally speaking, for any load within the capacity of a good type of motor.

NEW DESIGN FOR A COMPOUND DUPLEX PRESSURE PUMP.

The illustration given herewith is for a compound duplex pressure pump to develop a maximum pressure of 700 lbs. per sq. in.

The liquid end is of the end packed trombone style, the cylinders being made of special metal. Mounted thereupon are separate chambers for the location of the valves; chambers are also constructed of special metal and designed with a view of facilitating quick access for the inspection of the valves.

The valves are of the hydraulic pattern, made of steel and guided from below. An extension piece is provided for supporting the water plunger, and an approved adjustment device provided therefor.

The water end is mounted on heavy supporting columns. An engine of the transposed cylinder type is furnished, giving free access to all steam pistons without dismantling the pump.

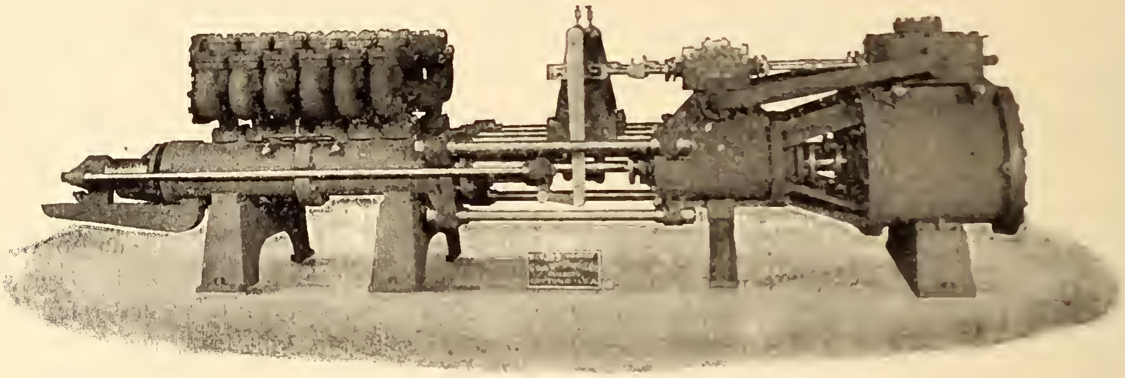
The outside valve adjustment is a feature of this design. Further particulars regarding this style of pump can be obtained from the manufacturers, The Stilwell-Bierce & Smith-Vaile Co., 278 Lehman street, Dayton, Ohio, U. S. A.

ANNUAL REPORT OF ROYAL ELECTRIC COMPANY.

The seventeenth annual meeting of the Royal Electric Company was held in Montreal on July 17th, at which the chief business was the reception of the annual report. The report in part stated:

The gross amount to credit of revenue accounts for the year aggregated $1,519,911.76; the gross amount to debit of revenue accounts for the year aggregated $921,980.27; leaving a balance of $597,931.49; from this is to be deducted: Interest and fixed charges to the sum of $41,239.06; leaving a net profit for the year of $556,692.43. Of this net profit the sum of $300,000 has been realized out of the investment in the Chambly Manufacturing Co.

Out of the above earnings there have been declared four quarterly dividends of two per cent. each, to the total amount of $157,026.14, leaving the sum of $399,666.29.



Smith-Vaile Compound Duplex Pressure Pump.

During the year expenditures have been made for additions to the plant of the company, as follows: To the factory and its equipment, $37,458.51; to the lighting stations, lines and installations and general construction, $135,106.34; making a total of $172,564.85.

The total net increase added to and connected with the alternating current system during the year was the equivalent of 14,460 incandescent lamps of 16 candle power each, and 2,176 horse power capacity in motors. The volume of business in the city, as well as many orders for electrical machinery and apparatus manufactured by the company, has been very satisfactory and gratifying.

The directors have made arrangements with the Chambly Manufacturing Company, which, subject to your approval, will enable your company to contain and control the whole of the power produced by that company on the Richelieu river, and to dispose of the stock and bonds which it now owns in that company upon advantageous terms; the whole in lieu of the contract now existing.

The agreement with the Chambly Manufacturing Company regarding the purchase of power was ratified. The terms of this agreement extend over a period of fifty years, and at the end of that time the whole reverts to the Chambly Manufacturing Company. The Royal Electric Company is to pay fifteen dollars per horse power for the first 15,350 horse power, and for all in excess of that amount at the rate of ten dollars per horse power.

The following were elected directors of the company for the coming year: Rodolphe Forget, J. A. L. Strathy, J. R. Meeker, H. B. Rainville, George Caverhill, James Wilson, F. C. Henshaw. At a subsequent meeting of the board, Mr. Forget was appointed president, and Mr. James Wilson vice-president.

In answer to a question, Mr. Browne stated that about 12 per cent. of the power will be lost in transmission from Chambly. The Chambly company reserve the right, if the Royal Electric do not exert themselves to obtain customers, to canvass themselves; but not to sell at a lower price.

If not already a member of the Canadian Electrical Association, you are invited to join the organization and participate in the approaching convention at Kingston, which will afford opportunity to make new acquaintances, renew old ones, and store up a stock of valuable information and enjoyment.

LIGHT
POWER
HEAT

The Royal Electric Co.

MONTREAL.
HALIFAX.

TORONTO.
VANCOUVER.

GENERATORS
MOTORS
TRANSFORMERS

The Royal Electric Co.

MONTREAL. TORONTO.
HALIFAX. VANCOUVER.

On October 15, 1895, the first "S.K.C." Generator manufactured in Canada was put in operation. To-day the following "S.K.C." Generators are in Service and on Order

COMPANY.	TOWN.	KILOWATT CAPACITY.
W. J. Fletcher	Alliston, Ont	60
C. O'Dell Electric Co	Annapolis, N. S	60
Baie St. Paul Electric Co	Baie St. Paul, Que	25
Corporation of Barrie	Barrie, Ont	150
Berlin Gas Co	Berlin, Ont	50
Bowmanville Electric Light Co	Bowmanville, Ont	90
Brantford Electric & Operating Co	Brantford, Ont	540 (2 MACH)
Cockshutt Plow Co	"	20
Wood Bros	"	50
Bridgewater Power Co	Bridgewater, N.S	40
G. H. Davidson	Brighton, Ont	30
Calgary Water & Power Co	Calgary, Alberta	150
Corporation of Campbellton	Campbellton, N.B	60
The Electric Co	Chicoutimi, Que	80 (2 MACH)
Drayton Electric Light Co	Drayton, Ont	40
Corporation of Dundalk	Dundalk, Ont	30
Edmonton Electric Light & Power Co	Edmonton, N. W. T.	75
Corporation of Farnham	Farnham, Que	30
Hamilton & Prout	Forest, Ont	30
Corporation of Fort William	Fort William, Ont	180
Trent River Paper Co	Frankfort, Ont	40
The Electric Light Co	Glen Williams, Ont	30
John Philip	Grand Valley, Ont	60
E.F.G. Fletcher	Gravenhurst, Ont	40
Greenwood Electric Co	Greenwood, B.C	150
Hamilton Electric Light & Cataract Power Co	Hamilton, Ont	6,840 (7 MACH)
Lake & Bailley	" "	50
Lawry Packing Co	" "	75
Volta Storage Battery Co	" "	75
Riordan Paper Mills Co	Hawkesbury, Ont	30
Corporation of Joliette	Joliette, Que	120
Kootenay Electric Co	Kaslo, B.C	75
J. T. Ayers	Lachute, Que	120
Corporation of Liverpool	Liverpool, N.S	75
Corporation of Markham	Markham, Ont	20
Corporation of Moncton	Moncton, N.B	60
Dominion Cotton Mills Co	Montreal, Que	180
McGill University	" "	10
Montreal Street Railway Co	" "	576 (2 MACH)
Montreal Water & Power Co	" "	360
The Royal Electric Co	" "	2,555 (11 MACH)
Labrador Electric & Pulp Co	Murray Bay, Que	125
Napanee Water & Electric Co	Napanee, Ont	35
Corporation of Newmarket	Newmarket, Ont	50

DIRECT CURRENT DYNAMOS AND MOTORS

RAILWAY GENERATORS AND APPARATUS - ELECTRIC SUPPLIES OF ALL KINDS

Write us your Requirements.

The Royal Electric Co.

MONTREAL. TORONTO.
HALIFAX. VANCOUVER.

COMPANY.	TOWN.	KILOWATT CAPACITY.
Eastern Townships Electric Light Co	North Hatley, Que	75
Corporation of Orillia	Orillia, Ont	600 (2 MACH)
Owen Sound Electric Illuminating & Mfg. Co	Owen Sound, Ont	50
Penman Manufacturing Co	Paris, Ont	30
Canadian Electric & Water Power Co	Perth, Ont	236 (2 MACH)
Electric Light & Power Co	Peterborough, Ont	180
Penetanguishene & Midland E. St. Ry. Co.	Penetanguishene, Ont	150
Corporation of Picton	Picton, Ont	120
Central Electric Co	Portage la Prairie, Man	150
Maple Leaf Rubber Co	Port Dalhousie, Ont	150
Montmorency Electric Power Co	Quebec, Que	4,080 (8 MACH)
Chambly Manufacturing Co	Richelieu, Que	16,000 (8 MACH)
A. Riendeau	Richelieu, Que	100
Richmond Co. Electric Co	Richmond, Que	60
W. McMahon	Ridgetown, Ont	60
Iron Mask Gold Mining Co	Rossland, B. C	150
St. Catharines Electric Light & Power Co	St. Catharines, Ont	200
Geo. Wilson & Co	" "	60
Welland Vale Manufacturing Co	" "	30
St. Jerome Power & Electric Light Co	St. Jerome, Que	75
St. Thomas Gas & Electric Co	St. Thomas, Ont	150
Shawinigan Water & Power Co	Shawinigan Falls, Que	288
Sherbrooke Gas & Water Co	Sherbrooke, Que	840 (3 MACH)
S. George	Stouffville, Ont	20
Corporation of Sudbury	Sudbury, Ont	75
Sussex Water & Electric Co	Sussex, N.B	40
Sydney Gas & Electric Co	Sydney, C.B	210 (2 MACH)
Teeswater Light & Power Co	Teeswater, Ont	20
North Shore Power Co	Three Rivers, Que	480 (2 MACH)
Tweed Electric Light Co	Tweed, Ont	30
Vankleek Hill Electric Co	Vankleek Hill, Ont	50
Windsor Electric Light Co	Windsor, N. S	140 (2 MACH)
Corporation of Winnipeg	Winnipeg, Man	75

77 Companies 117 Generators 38,410 KILOWATT CAPACITY

Customers are Best References

Apparatus Speaks for Itself

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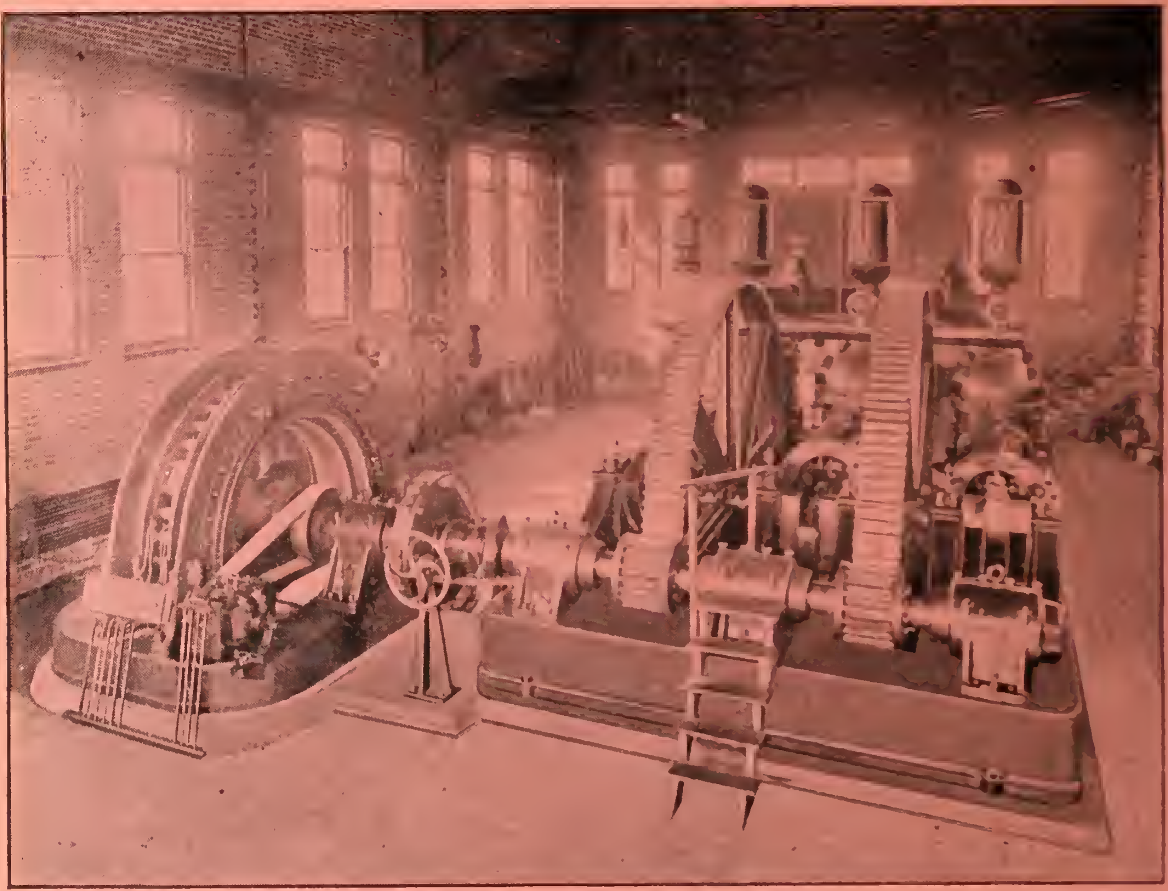

480 H. P. SYNCHRONOUS MOTOR DIRECT CONNECTED TO PUMP AT ST. CUNEGONDE PUMPING STATION OF THE MONTREAL WATER & POWER COMPANY.

Manufactured and Installed by . . . .

The Royal Electric Co.

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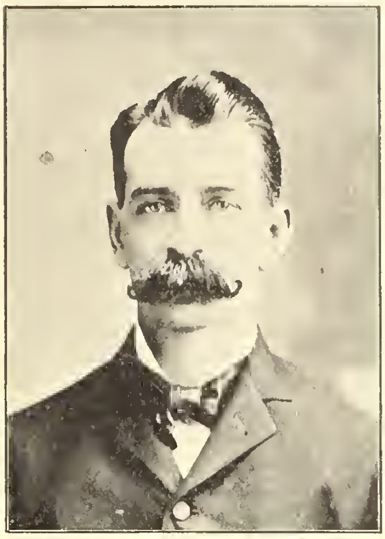


Mr. W. J. Camp, Montreal.

Mr. F. H. Leonard, Jr., Montreal.

Prof. R. B. Owens, Montreal.

Mr. A. G. Grier, Montreal.

AUTHORS OF PAPERS, CANADIAN ELECTRICAL ASSOCIATION CONVENTION, KINGSTON, 1900.

PLYMOUTH CORPORATION ELECTRIC WORKS.

By Burcham Harding.

The ceremony of opening the Plymouth Corporation Electric Works at Prince Rock, and the inauguration of electric tramways, took place September 22nd last. Plymouth was the first town in England to be incorporated by Act of Parliament, and was equally the first city to design an electrical plant combining both lighting and power. The business of the corporation has had so rapid a growth that within six months of commencing operation a contract has been placed which will double the supply of current.

The power plant is built on corporation land at Prince Rock, on the Cattewater, the estuary of the river Plym. Three Lancashire boilers, rated at 350 horse-power each, furnish steam; they are operated at a pressure of 130 pounds, but are constructed for a working pressure of 160 pounds to obviate reducing the working pressure as the boilers become old. Welsh coal is delivered by steamer to the wharf alongside the power house, and a branch of the London and South Western Railway runs in front of the works, which are thus supplied with ample accommodation both by land and water. Mechanical cokeing stokers are fitted to each boiler, and a complete system of coal handling arrangements conveys the supply of fuel mechanically from the coal stores to the furnaces. An electric motor operates the mechanical stokers. An economizer of 256 tubes has been erected beside the boilers. A cast iron tank holding 28,000 gallons, upon the roof of the coal store, is fed by a three inch pipe from the town mains, the supply of water being paid for at 2d. (four cents) per thousand gallons. Alongside the power house there will shortly be constructed a refuse destructor for the town garbage. The electricity committee of the Corporation will pay the works committee, who are responsible for the destructor, at the rate of one farthing (one-half cent) per k.w. hour of electric energy produced. This arrangement will make a considerable saving in the cost of fuel for the electricity works, and will give over $7,500 a year to the credit of the destructor.

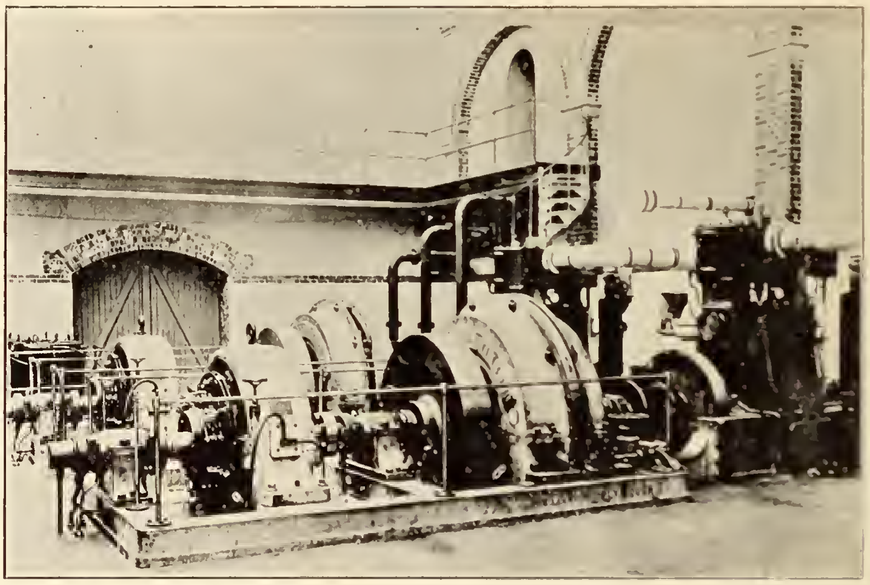


Fig. 1.—100 k. w. Westinghouse Direct Current Generators and Alternator.

The generating machinery is contained in a bvilding constructed principally of limestone. The spacious and lofty machinery room is designed to accommodate further units than are at present erected. The lighting and power plant are coupled together in a somewhat ingenious manner. The electrical equipment of the tramways was carried out by the Westinghouse Electric Company, Limited. Illustration No. 1 shows two sets of generators, each unit consisting of a high speed compound engine of 150 h. p. and 275 r. p. m., direct coupled by means of a friction clutch to an alternator of 100 k. w., and also to a Westinghouse direct current generator of 100 k. w., both being on the same side of the steam engine. The engine is capable of driving either the alternator or the generator at full load, or both at half load, or each one in such proportion as the calls for alternating or direct current may require.

A storage battery of 260 Tudor cells is in parallel with the generator. During the day the engine can be run at full load, the alternator supplying whatever small amount of current is required for lighting, and the generator supplying direct current for the tramways. The storage battery, in parallel with the generator, provides for any heavy demand for the tramway service, any current beyond the needs of the tramway line being stored by the battery. By this means a practically constant load is kept upon the engines, and the cells of the battery are continually being charged or are discharging, according to the demand of the circuit.

During the evening the demand for current for lighting purposes increases, and the supply of current for the tramway line is gradually taken off the generator and supplied by the battery, leaving the engine free to drive the alternator at full load for lighting. After midnight, when the lighting circuits are virtually closed and the cars have ceased running, the generator is driven at full load for charging the battery, until six o'clock in the morning, when the cars again commence to run.

The power house also contains two 200 k. w. alternators, supplying current for lighting, driven at 250 r. p. m., and a 20 k. w. booster, motor driven, used in series with the D. C. generator so that the bus-bar pressure need not be raised. The booster generator is so arranged that when the demand for current is equal to the output of the generator, the battery will neither charge nor discharge. When the line current is less than the output, the booster will aid in the charging of the cells. When the line current is greater than the output, the booster will add a pressure to the battery circuit and thus help it to discharge.

Between each of the engines and the alternators and Westinghouse generators shown in the illustration, is a special shaft coupling, so that the engine can be disengaged when desired. The use of the clutch enables the generator and alternator to be used independently of the engine. On Sundays when no cars run, the generator is operated as a motor from the storage battery, driving the alternator for whatever light load there may be. Similarly, the alternator can be run as a synchronous motor from either of the other alternators in the station, and the D. C. generator used either for charging the battery or for tramway work with the battery in parallel. This plant was designed some two years ago, but if it were designed today, according to the latest Westinghouse practice in the United States, instead of separate alternators and generators, a combination A.C. D.C. generator would be employed.

The storage battery consists of 260 Tudor cells, of 600 ampere hours capacity, the maximum discharge rate being 200 amperes. The Tudor Company maintain the battery under guarantee for ten years at a rate of five per cent. on the original cost. The contract stipulates that at any time within twelve hours of being fully charged, the battery must give its full specified capacity of 600 ampere hours without the voltage per cell falling below 1.85 volts.

The power house is equipped with three switchboards for the lighting and power circuts, which are erected on a gallery upon two sides of the machinery room. The alternating current switchboards is of the ordinary pattern, arranged on the single pole principle. The direct current tramway switchboard is of the usual Westinghouse design, being shown in Fig. 2, and is fitted with instruments for controlling and regulating the current. The regulating resistances are fixed in a room immediately under the swithboard recess.

The length of the tramway lines already opened is 3 1/10 miles, running from the Theatre Royal to Prince Rock, but this is only a part of the projected line. Extensions are being made to Hyde Park, at Mutley, and from the Market Place to Compton, passing through the residential district of Mannamead, and later on wi be further extended to Pounds and Lipson. Now that these additional lines are approaching completion, the present type of combination generators will not be continued, but there will be installed a steam driven direct current Westinghouse generator of 500 k. w., a battery for 1700 ampere hours at Compton, a 36 k. w. booster, and a 200 k. w. motor alternator.

Five direct methods of carrying the overhead wires have been employed to suit the character of the road. Owing to the great number of telegraph and telephone wires, guard wires have been used for more than half the route, which rather distracts from the exceptional artistic appearance of the overhead construction. The poles are three sectional, with S. S. S. joints, of 7 inches, 6 inches and 5 inches outside diameter, with heavier poles of 8 inches, 7 inches and 6 inches diameter at curves. There are a few single tube poles, 8 inches in diameter for half way and then tapering to 6 inches at the top. Arc lamps are fixed on the top of alternate poles in a number of the streets, and where possible on alternate sides of the street, a fiddle bow suspension, between the ears, holding the wires, has been fitted to avoid oscillation of the lamps. The line is divided into ½ mile sections, according to the English Board of Trade requirements, and insulated in the usual manner. Of the section boxes, two have been very neatly built into the walls of the Corporation building. They contain four switch fuses, lightning arrester, telephone and wire terminals.

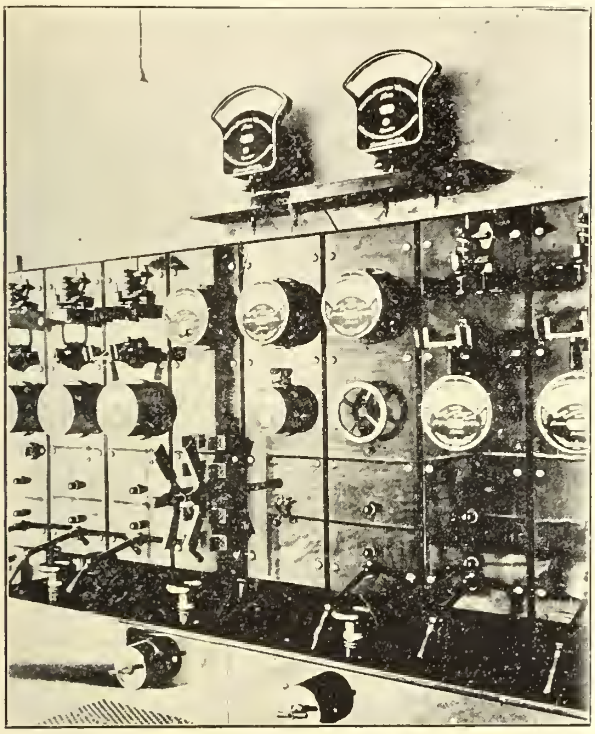


FIG. 2.—WESTINGHOUSE SWITCHBOARD.

The motor cars have a seating capacity for twenty inside and twenty-two outside. Each car is fitted with two Westinghouse No. 46 motors, giving 1,000 pounds tractive effort, at eight miles an hour. The controllers are of the Westinghouse series parallel type, with graded brake. Perfect control is kept over the car by putting the two motors in parallel, and by connecting them by a variable resistance, if necessary to the extent of short circuiting the motors. This brake has been working very satisfactorily. The tracks are double nearly all the way. The rails are grooved girder section, 92 pounds, 30 feet in length. The extensions are laid with sixty foot rails. Each joint is bonded with three No. 000 Chicago bonds, 30 inches long. The tests of the conductivity have given most satisfactory results. Probably no more difficult piece of tramway equipment has yet been completed in England, since the three miles already laid is through tortuous and narrow streets with extremely sharp curves.

The combination of supplying both light and power from the same units enables the Corporation to fix a low price for tractive purposes and for lighting circuits. In fact, Mr. Rider, the electrical engineer of the Plymouth Corporation, in a speech made at the opening ceremony, stated that the prices charged were the lowest that had ever been offered at the opening of any electricity works. The tramway is charged 3½ pence (seven cents) per unit up to 150,000 units per annum; beyond this figure there will be a reduction in price. The contemplated extensions to tramway lines will necessitate some 600,000 units, the price for which, it is estimated, will be reduced to 2.3 pence (under five cents) per unit. The price for lighting for private customers is 4½ pence (nine cents) per unit, and the same rate has been made for public lighting. The charge for an arc lamp, including cost of cleaning and maintenance, for one year is £16 ($77.00). According to Mr. Rider, the cost of electric lighting in Plymouth is about double that of gas, but the former gives about twenty times as much illumination as the latter, so that in effect the public by using electricity obtain ten times as much value for their money. Twenty-one miles of mains have been laid on the three wire system of distribution, and a large number of houses and stores are being connected up. At the date when the plant was started, connections had been made for 5,000 lamps, and applications in hand showed that this number would be increased to 8,000 before the end of the winter.

The expectations of the resident engineer appear to have been more than realized, since the demand for current has already outrun the station capacity, and a contract has been placed with the British Westinghouse Electric & Manufacturing Company for a 500 k. w. direct current 550 volt engine type generator, to be direct connected to a steam engine running at 330 r. p. m. Two boilers of 350 h. p. each will be added to the present equipment.

For the summer railway traffic fourteen new cars are being built, to be equipped with Westinghouse No. 46 railway motors.

The telephone exchange at St. John, N.B., is to be thoroughly modernized, at a cost of upwards of $100,000.

The Vernon, Nelson and Kootenay Telephone Company are extending a line from Kootenay to the B. C. Mines.

The electric railway from Quebec city to Ste. Anne de Beaupre, built by the Quebec Railway & Lighting Company, is about to be opened.

The Bell Telephone Company have just put down an underground cable on Portage avenue, Winnipeg, said to be the largest yet used in Canada.

The Bell Telephone Company have recently completed a copper metallic line from Three Rivers to Shawinigan Falls and Grand Mere, Que., thus connecting those places with Montreal, Toronto and other large cities.

The T. Eaton Company, Toronto, have placed an order with the Canadian General Electric Company for two 225 kilowatt, 125 volt direct current generators. These will be direct driven by Robb engines. The installation when completed will, with one exception, be the largest isolated plant in the Dominion, the other being that of the Montreal Cotton Company at Valleyfield, Que.

It is expected that there will be a number of interesting exhibits of electrical and kindred appliances in connection with the annual convention of the Canadian Electrical Association to be held at Kingston on the 29th, 30th and 31st inst. Space, current and labor for this purpose are supplied free of charge to manufacturers and dealers.

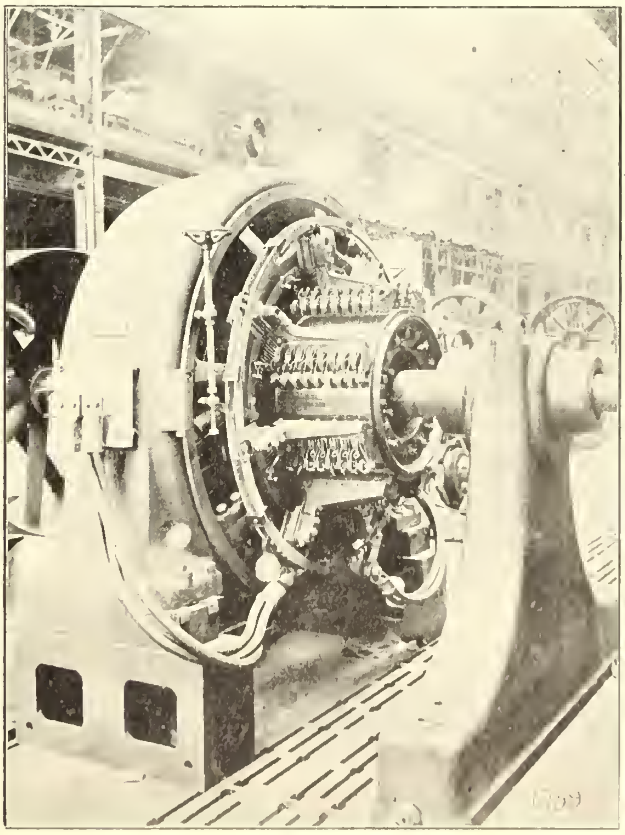


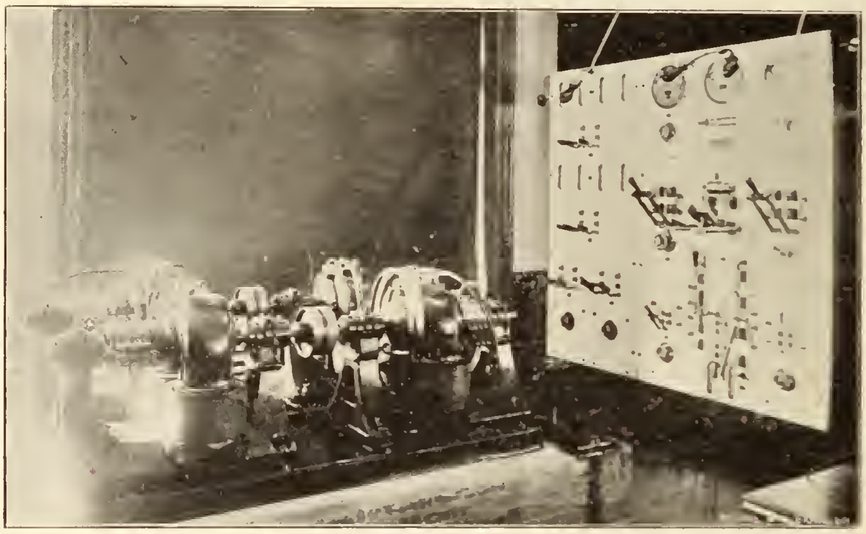
FIG. 3.—WESTINGHOUSE 500 K. W. DIRECT CURRENT GENERATOR—500 VOLTS.

TELEGRAPH and TELEPHONE

OTTAWA EXCHANGE OF THE BELL TELEPHONE COMPANY.

On April 12th, 1900, the lines of the Bell Telephone Company's subscribers in Ottawa were transferred from the old switchboard to a new one of the most recent type. The work necessitated by this transfer had been going on for over twelve months, during which time every line in the exchange system had been entirely rebuilt, giving all subscribers metallic circuits of copper and phosphor-bronze wire.

All lines entering the company's building on Queen street come in in cables through the basement from the street underground system. These cables vary in size from those containing 50 pair of wires to large ones of 200 pair capacity. The underground system has been greatly extended during the past year, until at present there are about 3,000 miles of telephone wires underground in the city of Ottawa. From the basement the cables are carried up a chute to an iron distributing frame in which changes of the location of the terminals of the lines are made and from which all testing is done. Here the cables are terminated in rubber-covered wire ends, which are attached to the protecting arrestors put into the line circuit, to prevent injury to the apparatus should an abnormal current of sufficient strength to do harm be conducted on to the line wires. From the main distributing frame the lines are carried in small 20 pair flexible cables to the intermediate distributing frrme, a structure similar in construction to the main distributing frame and from which cables are led direct to the switchboard. Connected to the intermediate frame is a relay rack on which are mounted the relays which control the various lamp signals on the switchboard.



Bell Telehhone Exchange, Ottawa—Machines and Power Switchboard.

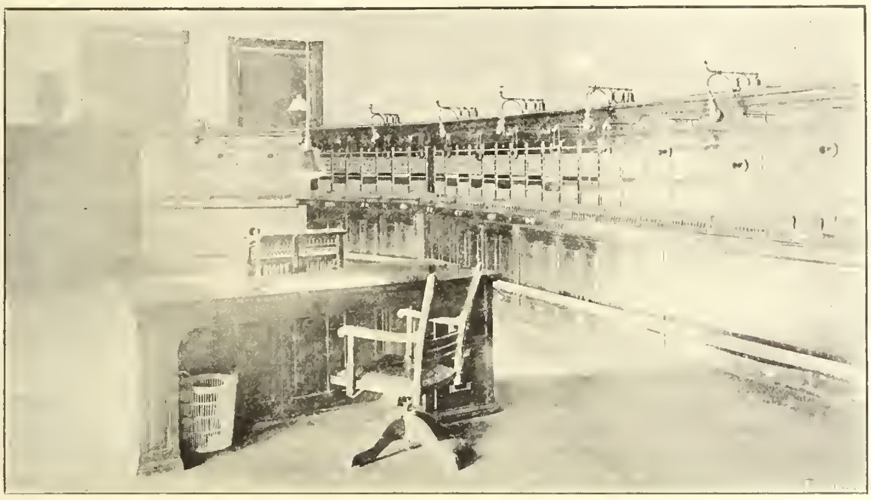
The necessary current for the operation of the switchboard and for the subscribers' transmitters (this being a common battery or central energy system in which local batteries at subscribers' stations are done away with, and all instruments are operated by one large battery at the central office) is furnished by a battery of eleven type "G 15" chloride storage cells having a capacity of about 1,200 ampere hours. For charging this battery two Western Electric dynamos, direct coupled to motors of the same make, are provided; one motor being run from a 500 volt circuit and the other a 250 volt circuit, thus giving an alternate charging machine in case of a break-down, either of the motor-generators, or of either of the outside power circuits.

Two dynamotors to furnish current for ringing the subscribers' bells are provided and arranged to be run from the storage battery. The switches, protectors, measuring instruments, etc., used in connection with the power plant are mounted on a marble switcboard in a convenient location near the machine, and large mains carry the current from this switch to bus-bars, which are mounted on a marble panel in the operating room, and from which panel leads are carried to the various sections of the switchboard. Protecting fuses are also mounted on this panel.

The last, but by no means the least important piece of apparatus in the exchange, is the switchboard itself. This is radically different in its mode of operation, though not in its appearance, from any other of the older types of switches. Formerly it was necessary, when a subscriber wished to call the central office, for him to ring the bell on his instrument, thus operating an annunciator in the central office; he then removed his telephone from the hook and waited for the operator to answer; it was necessary for the operator to restore this annunciator by hand. When the conversation was completed, the subscriber rang off (perhaps), displaying another signal similar to the annunciator, upon which the operator listened in on the line to see if the conversation was finished or if another connection was wanted. On account of a great many subscribers not ringing properly, it was necessary, in order to give good service, for the operator to come in on the line occasionally to see if the subscriber called for had answered, or ascertain if the conversation was completed, without a disconnect signal being sent in. This gave rise to the more or less annoying questions to the operator, "Have they answered?", "Are you finished?" etc.

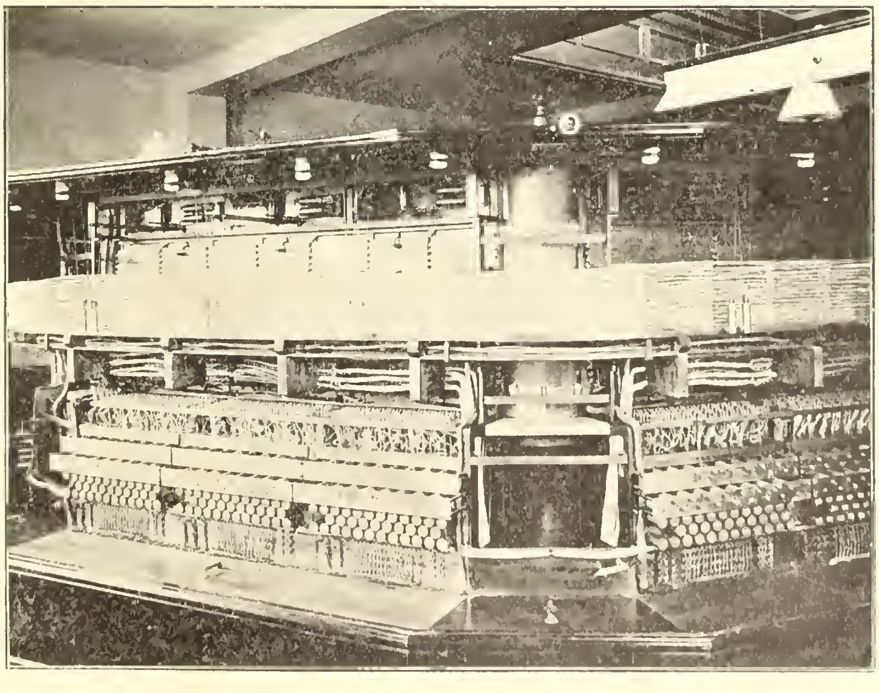
The present system is designed to obviate all this. A subscriber signals the central office by removing his telephone from the hook, which act lights a small incandescent lamp in front of the operator at the central office. Before her are a number of pairs of cords and keys similar to the usual operator's equipment, but with the addition of a small incandescent lamp connected in the circuit of each cord of the different pairs. The operator answers the subscriber by inserting a plug into a jack, or connecting point, immediately above the signal lamp; by so doing the line lamp is extinguished. The other cord of the circuit is then inserted into the connecting jack of the line called for and the subscriber is rung up in the usual way. Until he answers by removing his telephone from the hook the lamp connected with the cord circuit remains lit, being a signal to the operator that the subscriber has not answered and that she is to continue ringing until he does so. When both lamps in the cord circuit are out, it signifies to the operator that the conversation is in progress.

When both lamps light, it is a positive signal to the operator that both subscribers' telephones are on the hook and that the conversation is completed. When one or both lamps flash intermittently, it shows that one or both the subscribers are moving the switch hooks of their telephones for the purpose of attracting her attention. When a conversation is started, it is unnecessary for an operator to cut in on the line for any purpose, unless she sees this intermittent flashing of the lamp; in this way, interruptions to the subscribers' conversations are reduced to a minimum and the greater part of an operator's work is done by the eye, rather than the ear, making her work simpler and less arduous. The general result is a more satisfactory service all round.



Bell Telephone Exchange, Ottawa—Portion of Main Switchboard.

The long distance calls are handled at special sections of the switchboard in a manner very similar to the method described above; all calls being timed by a special recording machine, called a calculagraph, which reduces errors in time record to a minimum. New sets are now being installed in all subscribers' stations, and by the time this work is completed, the city of Ottawa will have a telephone equipment and service not surpassed by any city in America.



Bell Telephone Exchange, Ottawa—Rear View of Switchboard.

With the exception of the storage cells, charging and ringing machines, lamps, and cable, all apparatus used in the exchange and subscribers' stations was manufactured by the Northern Electric & Manufacturing Co., Montreal.

The plant was installed under the direction of the electrical engineering department of the Bell Telephone Co.

The Bell Telephone Company have just installed in the Goldie & McCulloch works, at Galt, Ont., a private telephone exchange, including five desk telephones and seven regular wall instruments. The Goldie & McCulloch Company also have a long distance equipment, and possess one of the most complete telephone systems in Canada. The Bell Telephone Company have also installed a ten set warehouse system for MacGregor, Gourlay & Co., and a seven set system for the C. Turnbull Company, all of Galt.

TELEGRAPHY IN THE ATLANTIC.

Mr. F. A. Hamilton, E.E., of Halifax, N. S., has recently completed his commission by the Commercial Cable Company in connection with the laying of a cable from Canso, N. S., to New York. In an interesting communication to the Electrical News, Mr. Hamilton says:—

"I am now testing the new Canso-New York cable during the gaurantee period, likewise the Canso-Azores cable recently laid by the "Faraday." This is an eventful year in respect to Atlantic telegraphy. Besides the last mentioned cable laid by the Sienems Bros., Ltd., from their ship the "Faraday," the India Rubber & Gutta Percha Company, with the "Silvertown," have laid the section which I am now testing. This cable is 895 nautical miles in length, and was paid out between July 10th and July 21st. Then there is the German cable now about to be laid by the S. S. "Anglia," belonging to the Telegraph Construction and Maintenance Co. All these companies' works are, as you know, on the Thames. The "Silvertown" is the oldest ship of the three. She was built by Mitchell & Co., of Newcastle, one year before the "Faraday," and is the larger vessel of the two. The latter vessel was built in the same stocks. The "Anglia" is the latest addition to the great telegraph fleet of the world. She is expected to arrive in New York on the ninth of August."

Mr. Hamilton has recently been appointed by the U. S. A. Signal Corps to accompany an expedition to the Phillipines, and expects to leave for New York immediately on the completion of his present contract. He will probably be absent about two months.

The Manhattan General Construction Co., of Newark, N. J., advise us that although midsummer is usually a dull season for arc lamp business, their orders for July, 1900, exceeded those for any one month in their experience, extending over the past seven years. The Manhattan Series A. C. System is being adopted very rapidly, a few of the orders closed recently being: Evanston Electric Ill'g Co., Evanston, Ill., 211 lamps; Fairport Electric Co., Fairport, N. Y., 60 lamps; W. M. Sheehan & Co., Wappinger Falls, N. Y., 52 lamps; Hagerstown Municipal Plant, Hagerstown, Md., 117 lamps; Town of Phillipi, W. Va., 20 lamps; Urbana Lt., Ht. & Pr. Co., Urbana, Ill., 78 lamps; N. Y., N. H. & H. R. R., Hartford, Conn., 50 lamps; Hamilton Electric Lt. & Pr. Co., Hamilton, Ont., 200 lamps. In addition to shipping 350 series A. C. lamps to the Northern Ohio Traction Co., of Akron, O., the Manhattan Company have received their order for 350 multiple A. C. enclosed arc lamps.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building.

MONTREAL, Aug. 6, 1900.

The Lachine Rapids Hydraulic and Land Company are to be congratulated on the manner in which they managed to keep their service going after their late fire at the McCord street distributing station, the delay being trifling. In fact, when one looks at such fires as occurred, for instance, in Toronto, and more recently Ottawa, where do we find any industry that works so unflaggingly to repair fire damage? In giving evidence regarding the fire, Alfred C. Reid testified that when the fire started he was in the switchboard room with Messrs. Dorais and Roberts. The switchboard was in the part facing on Seminary street. He was looking towards the switchboard, suddenly heard a roaring noise and saw issuing from the switchboard a large peculiar flame. The flame was about six feet from witness, who called to the men to get some sand to throw on the flames, for they could not use water. The switchboard was of maple and birch. On the back there was asbestos, and the switchblocks were on slate, and everything arranged so as to make the place as safe as possible. The sand put out some of the fire, but the flame was so hot that they could not get nearer than ten feet, and the flames presently extended to the other insulators. The heat melted the insulating covers and the flames extended in all directions. There are nine main wires coming to the switchboard from the transformers. The board in which the fire caught held only wires of 2,000 volts.

Quite a number of gasoline launches are now in vogue amongst our suburbanites, at Lachine, on Lake St. Louis, and elsewhere. Referring to those which utilize the gas and "fire" it with the electric spark every revolution or second revolution: How many owners have become disgusted, and probably blamed a good engine and boat simply through using improper batteries? Quite a number have sal-ammonic cells, and some even dry cells, although it is distinctly marked on them for "open circuit work." Now, such work can hardly be called "open circuit," and if some of the disgruntled ones will try one or other of the numerous makes using elements of copper oxide and zinc in a solution of caustic potash, they may find a change for the better. Such cells will run on "closer circuit" work, and this is pretty much what the service required is. It is necessary to have a cell or two more of these than of the sal-ammoniac or dry varieties, owing to their lesser voltage. A reserve set of dry cells, to carry you in should others fail, is not a bad precaution. Some iron contact pins are also in vogue; such should certainly be tipped with platinum, or preferably "platino-iridium," which, although more expensive, are harder and wear longer. Another point—do not connect cells up together with No. 20 magnet wire or No. 18 bell wire, but use No. 14 or even No. 12 rubber covered wire, and, lastly, see that spark coil is kept dry.

Railways, some how or other, seem to be at logger-heads with the public or their representatives, as shown lately in Toronto and Montreal. Now, were they to give the public one moment's consideration in some affairs, they might secure some champions from the ranks of the people; for instance, around Mountain street, in this city, the Grand Trunk railway manage to make night hideous with their shunting, as do the C. P. R. at Westmount (suburb). It would seem an easy matter to get a branch off the trolley of the Montreal street railway, which is adjacent to both railways mentioned, and use an electric locomotive to do the shunting. The stentorian puffs and whizzing of steam being absent, the nuisance would be minimized to such an extent as to come within the bounds of toleration.

There are certain electricians who "kick" at U. S. alien labor law allowing U. S. men to come into Canada and do electrical work, when they cannot do likewise across the border. Might one question be put to the kickers: Do they subscribe to the CANADIAN ELECTRICAL NEWS at $1 (only) per annum, or do they subscribe, and generally at higher expense, to alien electrical periodicals in the U.S.A.? There is no harm in their doing both, but "Canada first" should be the motto in this argument as well as in the other.

The old time controversy of direct vs. alternating for interior illumination in large cities seems to be pretty well settled in favor of the latter, although one of the arguments brought forward at the time by advocates of the former, viz., the danger of breakdown in transformers, permitting the high pressure current to enter buildings, is bearing abundant fruit at present. Of course, there has been considerable lightning about, which may have caused some of the trouble, but the half will never be known, as companies, and rightly so, frown down any publicity of such events whenever possible.

Has not the demand for high efficiency and low priced transformers got something to do with this state of affairs? In the past far less of this sort of thing was met with, although it is equally true that many more transformers are now in use. Whatever may be the cause, central stations should ferret it out, or some suitable device to prevent disaster when such an event does happen, as many of the general public are beginning to think that gunpowder and electric light (especially during thunder) are equally dangerous to have around. The underwriters, who make numerous regulations, should see that Tom Jones' house, wired in 1886, is not fed from the same transformer as is feeding Bill Smith's house, wired in 1900, as in so doing they bring the latter high risk down to the former low level.

All that the companies care is that the installation is safe "at the date when connected." True, they have inspectors, who no doubt condemn such faulty "fittings" as they may come across, but it is not reasonable to suppose that they cut the mains (where there is no main switch) and "ring out" the various residences for "grounds." A company's inspector may report "lack of main switch," and the tenant retort "looking for a job"; it would be otherwise, however, if from the official underwriters' inspector. The insurance companies lose most, and yet seem to fear the expense of employing an electrical expert whose sole duty it would be to coach and confer with the usual routine inspectors of the underwriters. It has got to come some day, and the time is ripe now. So far indoor wiring has had all of the attention, such as it is; there is evidence, however, that a little attention to outdoor wiring, transformers, grouping of buildings, etc., of this nature would not be amiss.

SPARKS.

The British Columbia Electric Railway Company are building an extension of their road from New Westminster to Supperton.

The Hamilton Gasoline Engine & Automobile Company, Limited, has been incorporated, with a capital of $40,000 and head office in Hamilton.

The Cape Breton Tramway & Electric Company, with a capital of $500,000, have decided to build an electric railway connecting Sydney, Glace Bay, and Sydney Mines.

The Central Electric Street Railway Company have made a proposition to build a street railway along the streets of Sarnia. The Sarnia Street Railway Company have asked a similar franchise.

A by-law to raise $100,000 to purchase the electric light and gas plants of the Brockville Light & Power Company was sanctioned by the ratepayers recently. A vote as to whether the plant should be under the control of the town council or five commissioners resulted in favor of the latter.

The Penman Manufacturing Company, Paris, Ont., are installing a new electric plant in their No. 1 mill, and have purchased a 55 kilowatt multipolar generator from the Canadian General Electric Company for the purpose. This is the fourth plant the Canadian General Electric Company have supplied to the Penman Company for their different mills.

The Electrical Construction Company, of London, Limited, have received orders from G. E. Matthews, Montreal, Que., for one 6 h.p. motor; Clark, Pennock & Co., London, Ont., one 8 h.p. bipolar motor; Malloch & Co., London, Ont., three 6 h.p. elevator motors; Burnett & Sons, London, Ont., one 8 h. p hoisting motor, with controller.

The Mail Job Printing Company., Toronto, have placed their order for six slow speed press motors with the Electrical Construction Company of London, Limited. This order, together with the three recently placed for the same purpose with the Salvation Army, Toronto, and two with the W. J. Gage Company, Toronto, show the general favor with which these special slow speed motors are regarded.

The Canadian Electrical Association is ten years old. Will you assist to celebrate the event at Kingston on the 29th, 30th and 31st inst.

ENGINEERING and MECHANICS

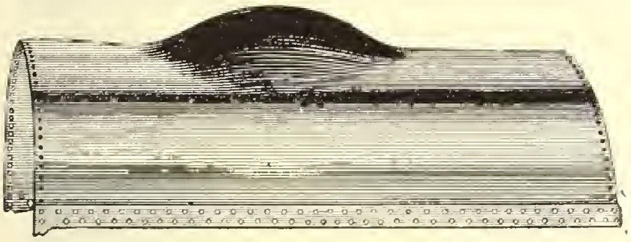
ANNUAL CONVENTION OF STATIONARY ENGINEERS.

The annual convention of the Canadian Association of Stationary Engineers will be held in Toronto commencing on Tuesday, August 28th, at 11 o'clock a. m. Arrangements have been made for an interesting programme, including papers on "Chimneys" and "Injectors" by Messrs. E. J. Philip and A. E. Edkins. Mr. H. E. Terry is chairman of the local committee, the members of which are working energetically to make the convention even more successful than any held heretofore. As the Toronto Exhibition will be in progress, reduced railway fares from all parts will be obtainable, and there is reason to expect a large attendance of members and visitors. The meeting place will be Engineers' Hall, 61 Victoria street. Particulars regarding the convention will be gladly furnished by Mr. A. M. Wickens, executive secretary, 280 Berkeley street.

THE EFFECT OF OIL IN BOILERS.*

We often referred to the fact that the presence of grease or any of the animal oils in steam boilers is almost certain to cause trouble. Our illustration gives a better idea of the effect produced than pages of verbal description possibly could. It is from a photograph and is no wise exaggerated.

The boiler from which the plate shown in the cut was taken was a nearly new one. It was made of a well-known brand of mild steel, and that it was admirably adapted to the purpose for which it was used, is proved by its stretching as it did without rupture. The dimensions of bulge shown are four feet lengthwise of the boiler, three feet girthwise and nine inches deep. The metal, originally 5-16 of an inch thick, drew down to 1/8 inch in thickness at the lowest point of the "bag" without the slightest indication of fracture.



Effect of Oil in Boilers.

The circumstances under which the bulge occurred may best be described in the words of the inspector who examined the boiler, and are as follows:

"Last Tuesday morning I was called in great haste to the——— works. Upon arrival I found one of the boilers badly bulged, and with twenty pounds of steam up. I could give no explanation until I had thoroughly examined the internal parts of the boiler. I gave directions for cooling the boiler and ordered top man-hole plate to be loosened, but not to be taken out until my arrival in the afternoon, that I might see everything undisturbed. This was done. On my arrival I took out the man-hole plates in top of shell and front head * * * and made an examination."

"I found the boiler had been cleaned from preceding Sunday, and at that time a gallon or more of black oil had been thrown into it. Monday morning the boiler was fired up and was run through the day at a pressure of 90 pounds per square inch. At six o'clock Monday night the engine was stopped, the drafts were closed, and no more firing was done until nine o'clock. Upon going to fire up at this time, the bulge was observed. From six to nine o'clock a pressure of only 40 pounds was carried.

"Upon examination I found the entire boiler saturated with this oil."

This is almost certain to be the result of putting grease into a steam boiler. It settles down on the fire-sheets, when the draft is closed, and the circulation of water nearly stops, and prevents contact between the plates and the water. As a consequence, the plates over the fire become overheated; and under such circumstances a very slight steam-pressure is sufficient to bag the sheets. Unless the boiler is made of very good material, the plate is very apt to be fractured, and explosion is likely to occur.

When oil is used to remove scale from steam-boilers, too much care cannot be exercised to make sure that it is free from grease or animal oil. Nothing but pure mineral oil should be used. Crude petrolium is one thing; black oil, which may mean almost anything, is very likely to be something quite different.

The action of grease in a boiler is peculiar, but not more so than we might expect. It does not dissolve in the water nor does it decompose, neither does it remain on top of the water, but it seems to form itself into what may be described as "slugs," which at first seem to be slightly lighter than the water, of just such a gravity, in fact that the circulation of water carries them about at will. After a short season of boiling, these "slugs" or suspended drops seem to acquire a certain degree of "stickiness," so that when they come in contact with shell and flues of the boiler, they begin to adhere thereto. Then under the action of heat they begin the process of "varnishing" the interior of the boiler. The thinnest possible coating of this varnish is sufficient to bring about overheating of the plates, as we have found repeatedly in our experience. We emphasize the point that it is not necessary to have a coating of grease of any appreciable thickness to cause overheating and bagging of plates and leaking at seams.

The time when damage is most likely to occur is after the fires are banked, for then, the formation of steam being checked, the circulation of water stops and the grease thus has an opportunity to settle on the bottom of the boiler and prevent contact of the water with the fire-sheets. Under these circumstances, a very low degree of heat in the furnace is sufficient to overheat the plates to such an extent that bulging is sure to occur. When the facts are understood, it will be found quite unnecessary to attribute the damage to low water.

Thie accident also serves to illustrate the perfection to which the manufacture of steel or boiler plates has attained. It would be an extraordinarily good quality of iron that would stand such a test without fracture.

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* From the eighth edition of "Helios," published by the Heine Safety Boiler Company, and reproduced by permission.

TRADE NOTES.

Messrs. Geo. May & Sons, Ottawa, have placed an order with the Electrical Construction Co. of London, Ltd., for a 5 h. p. motor.

The Goldie & McCullough Company, of Galt, Ont., have installed a 10 h. p. "Model" gasoline engine at the Royal Military College, Kingston.

C. W. Thompson, of the Napanee Mills Paper Company, Newburg, Ont., is replacing his arc lighting plant with a complete direct current incandescent system, supplied by the Royal Electric Company.

Messrs. Jack & Robertson, of Montreal, have recently been appointed Montreal sales agents for the Robb Engineering Company, of Amherst, N.S., manufacturers of the celebrated "Robb" engines, "Mumford" boilers, feed water heaters, etc.

The Volta Electric Storage Company, of Hamilton, Ont., is installing a 120 k. w., 110 volt, bi-polar direct current generator and a 25 k. w. direct current 250 volt multipolar generator for charging batteries and for testing purposes, purchased from the Royal Electric Company.

Mr. R. E. T. Pringle, dealer in electrical apparatus and supplies, Montreal, is about to open an establishment at 72 Prince William street, St. John, N. B. This branch will be in charge of Mr. Geo. C. Rough, who has been sales manager at Montreal for Mr. Pringle for the past four years.

The Dominion Government has placed an order with the Royal Electric Company, of Montreal, for a 30 k. w. direct current multipolar generator, direct connected to a Robb-Armstrong engine, together with a marble switchboard, and arc and incandescent lamps to light the docks at Sorel, P. Q.

The following are a few of the orders received by the Electrical Construction Co. of London, Ltd., during the last month: Messrs. Lamb & Bate, Stratford, 3 h. p. motor; Chas. Allan, Ingersoll, 2 h. p. motor; Mitchell & Co., Ingersoll, 3 h. p. motor; Thos. A. Cooley, Peterborough, 1 h. p. motor; G. E. Matthews, Montreal, two 2 h. p. motors.

The Electrical Construction Co., Ltd., of London, recently received the following orders from their agents in Winnipeg: Two one h. p. motors, 2 h. p. motor, 3 h. p. motor, 4 h. p. motor, 8 h. p. motor, 30 light dynamo. Messrs. Hoffmeister Bros., Vancouver, B. C., have placed an order for a 3 h. p. multipolar motor with the Electrical Construction Co. of London Ltd. The Georgian Bay Navigation Co., Collingwood, have placed an order with the same company for the supply of a 150 light dynamo, including the complete wiring of their boat Britannic.

QUESTIONS AND ANSWERS.

A Montreal correspondent asks: "What are the changes, if any, necessary in the connections of (a) a series, (b) a shunt, (c). a compound wound dynamo, in order to keep the polarity of the circuits the same, when the dynamo is running in the opposite direction to its original rotation?

ANSWER: If it is necessary to change the direction of rotation of any dynamo, the easiest way to maintain the same polarity in the circuit is to reverse the terminals of the circuit at the terminals of the dynamo. This would apply to any description of dynamo.

SPARKS.

The Herald Publishing Company, Montreal, have purchased a 30 h.p. 250 volt motor from the Canadian General Electric Company.

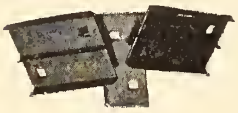
The Canadian General Electric Company have sold the Guelph Street Railway Company one of their standard General Electric 1,200 two motor railway equipments, complete with two k. 21 controllers.

The Plessisville Electric Company, of Plessisville, Ont., have recently installed a 120 k.w. single phase alternator purchased from the Canadian General Electric Company.

The Ottawa, Brockville and New York Railway Company propose, it is said, transmitting electric power to the town of Brockville. Messrs. Geo. E. Kidd and James Stratton, of Ottawa, are interested.

Those who attend the Convention of the Canadian Electrical Association at Kingston on the last three days of this month will see, in the best and most comfortable manner and in excellent company, the beauties of the famous Thousand Islands.

FOR SALE—A Five-Hundred Alternating Westinghouse Dynamo; one thousand volts. G. FENSOM, Chesley, Ont.



Tie Plates

Keep rails in Surface Gauge and Line.
Quadruples Life of Ties.

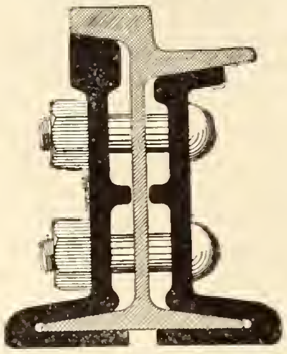
Pearson Jacks

Quickest and Best Rerailing Device for Electric Roads.

Q. & C. Track Jacks.
Q. & C. Rail Drills.

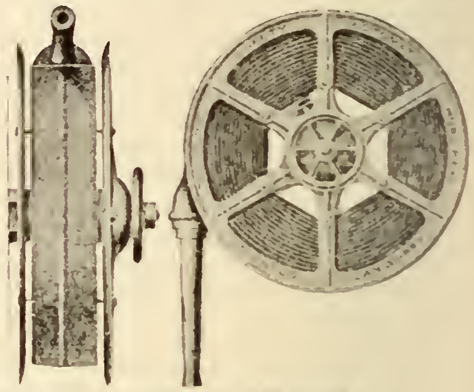
Bryant Rail Saw

Saves taking rail from track, saves labor and cost, and makes a job.



Continuous Rail Joint

Strongest Joint made.

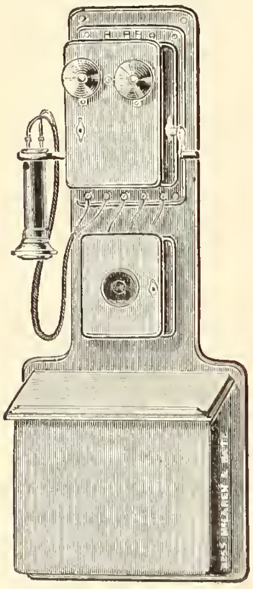


Automatic Reel

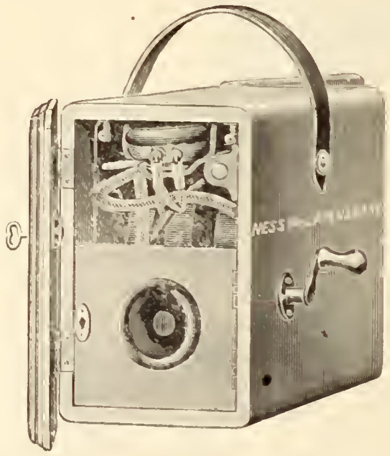
Unwinding Hose opens Valve. Water at nozzle when Hose is unreeled.

F. E. CAME, Manufacturer, 17 Place d'Armes Hill MONTREAL

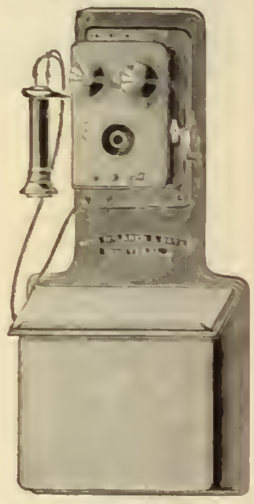
TELEPHONES



MAIN LINE

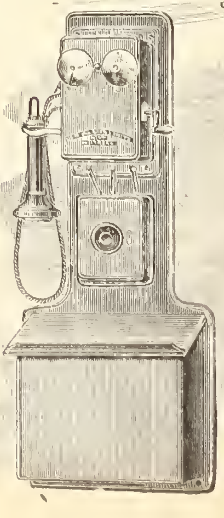


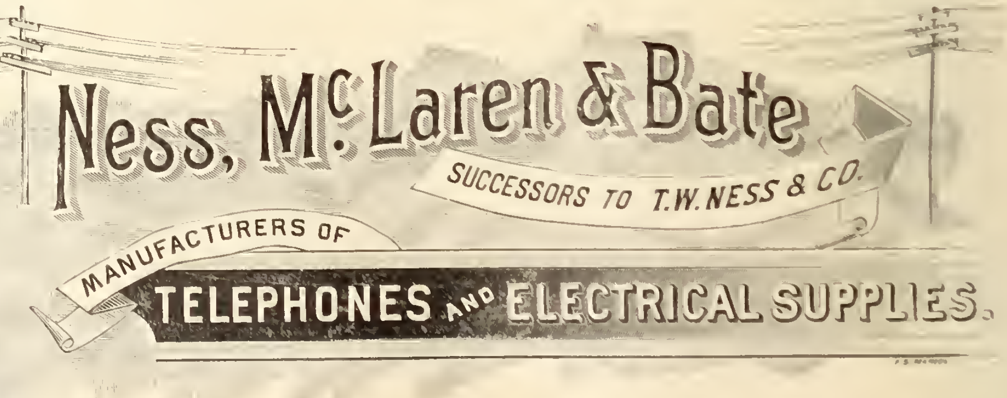
PORTABLE



WAREHOUSE

ALL INSTRUMENTS GUARANTEED FULLY. SEND FOR CATALOGUES.





Ness, McLaren & Bate
SUCCESSORS TO T.W. NESS & CO.
MANUFACTURERS OF
TELEPHONES AND ELECTRICAL SUPPLIES.

419 St. James Street
Corner Craig
MONTREAL

SPARKS.

The electric light plant at Danville, Que., was recently sold at auction to Thomas Crockett for $6,500.

The Paisley Electric Light Company have purchased a 1,200 light S. K. C. generator from the Royal Electric Company.

The Almonte Electric Light Company have not yet been successful in securing a renewal contract for street lighting in the town of Almonte, Ont.

The electric light plant at Revelstoke, B. C., may be purchased by the corporation. Col. Tracey, C. E., of Vancouver, recently valued the plant.

The Royal Electric Company, of Montreal, have been given a contract for 20 years for street and commercial lighting within the corporation of St. Laurent, Que.

The Ballard Electric Co., Toronto, have recently sent out a neatly printed catalogue of 100 pages, containing numerous illustrations and prices of electrical supplies.

Owing to some disagreement, the town of Springhill, N. S., is reported to be in darkness, but the authorities are making an effort to install a new electric light plant.

The town council of Yarmouth, N. S., have accepted the offer of the Yarmouth Gas Light Company to light the streets of the town for one year, at the price of $3,500.

The Canadian General Electric Company have just completed the installation of one of their standard 60 kilowatt single phase alternators for the Leamington Electric Light Company.

The Fensom Elevator Company have secured the contract for the erection of an electric elevator to be operated in connection with the rapid handling of mail matter at the Union Station, Toronto.

The Canadian General Electric Company have recently received an order from the Lake Superior Power Company, Sault Ste. Marie, for a 400 h.p. 500 volt direct current dynamo, with switch-board complete.

The Renfrew Electric Company, of Renfrew, Ont., held its first semi-annual meeting recently, and after only six months of corporate existence, declared a dividend on the basis of 6 per cent. per annum.

The Canadian Electric & Water Power Co., Limited, of Perth, have purchased a water power at Glen Tay, three miles from Perth, on the Tay River, where they intend installing an electric plant as an auxiliary to their present plant.

The Canadian Manufacturer has recently published a special number, in which is printed in detail the Canadian, United States, British and Newfoundland customs tariffs. This number will no doubt be found very useful for reference.

Almonte, Ont., town council voted down a resolution to accept the offer of the Almonte Electric Company for a ten years' contract for street lighting until midnight at $55 per 2,000 c. p. lamp per annum. It is likely that the corporation will purchase a municipal plant.

Mr. J. P. Graves has submitted a proposition to acquire the waterworks and electric light plants at Grand Forks, B. C., for 25 years. Mr. Graves offers to pay the corporation $70,000 and to expend $30,000 in improving the plants. He has also submitted a proposition for the construction of an electric railway.

The Canadian Woollen Mills Company, of Carleton Place, Ont., have just purchased from the Canadian General Electric Company an electric plant for transmitting power and light to their various mills. The order consists of one 100 h.p. multipolar 500 volt generator, one 75 h.p. multipolar 500 volt motor, and all the necessary switch-board apparatus.

The American Alkali Company, of Saulte Ste. Marie, Ont., have recently put into operation the two 225 k.w. 200 volt generators purchased from the Canadian General Electric Company. These generators are direct connected to water-wheels operating at a speed of 200 revolutions per minute. The process used by the Alkali Company is one of the most interesting in the country.

Mr. J. A. Valois, manager of the Chambly Electric Company of Montreal, in company with Mr. J. G. Petit Clair, foreman of the same company, have within the last month visited New York, Philadelphia and Chicago, where they purchased a few thousand dollars worth of electric light and electro medical apparatus. It is rumored that their company have a large contract in view.

The Canadian General Electric Company have received an order from the Aylmer Electric Manufacturing Company, Aylmer, Ont., for one of their standard 2,000 light revolving field monocyclic alternators, with panels. This is a type of machine which will be very much sought after in the future where it is desired to furnish electric power to polyphase motors of all sizes and still maintain the simplicity of single phase distribution for lighting.

The Rev. Sisters of St. Anne, inaugurated about the end of July their new incandescent lighting plant installed at their convent at Lachine, P. Q. The plant was put in by the Chambly Electric Company, of Montreal. Mr. J. A. Valois, manager of that company, at first signed a contract for the installation of a few lamps, but the sisters after seeing the advantages of electric light over coal oil lamps, decided to install an 800 light plant.

It is said that a company is being formed to manufacture incandescent coal oil lamps after a model invented by Mr. V. L. Emerson, of Ottawa. The incandescence is created by blowing a thin stream of coal oil in a spray over a film shaped liked the auer light burner. The result is said to be a light of much higher brilliancy than an ordinary sixteen c. p. electric light, while the cost is claimed to be but one-tenth of a cent per hour.

The city council of St. John, N. B., recently invited tenders for electric street lighting. The Carleton Electric Light & Power Company tendered to light the west side of the city at $105 per light per year. The St. John Railway Company offered to supply 90 lights for the Portland side at $75 per light per year, and to light the east side of the city for $85 per light per year. The Board of Public Safety have recommended that the council accept the tender of the St. John Railway Company.

Mr. Roderick J. Parke, consulting engineer, of Toronto, has been engaged by the municipal council of St. Marys, Ont., to prepare plans and specifications for the reorganization and combination of the present municipal arc lighting plant and the incandescent lighting plant recently acquired by the corporation from the Reesor Company. A new power station will be erected and a completely new engine and boiler plant will be purchased and installed. Work will be commenced as soon as possible.

The construction of the Crocker improved turbine is well shown in the fourth edition of the Jenckes Machine Company's water wheel catalogue. The various illustrations pertaining to the Crocker wheel show the adaptability of the Crocker turbine to varying requirements and local conditions. The tables of horse powers, which are guaranteed to be substantially correct, have been extended from 40 feet to 100 feet head. The figures are given for any wheel from 15 to 55 inches. There are also other valuable tables, which evidently have been prepared to meet the needs of the practical man and to facilitate the calculations and estimates required in connection with water wheel work. Diagrams of the principal methods of setting have also been inserted.

The Niagara, St. Catharines, & Toronto Railway Company, of St. Catharines, have just placed and order with the Canadian General Electric Company for two 300 kilowatt rotary converters, together with switch-board panels and high potential transformers of the oil cooled type complete. The transformers for this installation are very special in their construction, each having a primary connection for 2,200 volts, 11,000 volts, 22,000 volts, with secondaries of 375 volts. Total capacity of the six transformers will be 800 horse-power. The railway has already commenced operations in a temporary way until such time as they can procure power, and from the business being done there can be no doubt that this will be one of the most successful electric railways in Canada.

A wave motor is being built at Atlantic City by the Atlantic Wave Motor & Power Company, of Philadelphia, the object, of course, being to utilize the rise and fall of the sea to generate electric power. Henry C. Essington, the inventor of the machine, describes it as follows : "A ball twelve feet in diameter, on a revolving shaft with two yokes of solid cast steel weighing 850 pounds each, attached to a solid rocker arm or segment weighing 2.010 pounds, with a tensile strength of 60,000 pounds to the square inch. The whole attached to a twelve-foot revolving turntable which will hold the machinery, and to accommodate itself, and oscillates in accord with all the changes of the wind or current, the rise and fall of the tide, waves motion and swell of the ocean. The ball in riding the waves will be submerged two feet, and revolve on the axle or shaft continuously from the incoming waves, thereby relieving the strain from the machinery. We obtain direct power by discharging the water into the bottom of the receiver from the pump supplying the turbine wheel from an outlet which is placed on the bottom of the receiver. This receiver will act as an air chamber to a pump, and will fill the other part of the receiver with compressed air, which will force the water against the turbine."

SPARKS.

The Canadian General Electric Company are just completing the installation of one of their 300 k.w. monocyclic alternators for the Winnipeg Street Railway Company.

The members of the Toronto Railway Electrical and Mechanical Benefit Association held their annual excursion to St. Catharines a fortnight ago. About 500 persons enjoyed the outing.

The Canadian General Electric Company are supplying the Tagona Water and Light Company with two 35 light 6·8 ampere arc dynamos, complete with lamp. This plant is to be used for lighting docks, etc., at Michipicoton.

The Volta Electric Storage Company, Limited, of Hamilton, is installing a battery switch-board for Mr. W. E. H. Massey, at his farm at East Toronto. This switch-board is being built by the Royal Electric Company.

The Central Peat Company, Welland, Ont., have placed an order with the Electrical Construction Company, of London, Limited, for one 25 h.p. multipolar generator, and one 15 h.p., one 10 h.p., and one 5 h.p. multipolar motors, to operate their works at Welland.

The Galt Gas Light Company, of Galt, Ont., have ordered from the Royal Electric Company a 100 k.w. S.K.C. generator, with switch-board and exciter, also a switch-board for their present single phase alternator and one for their arc lighting system.

A project is said to be under consideration involving the construction of an electric railway from Three Rivers to Grand Mere, Que.

The Electrical Construction Company, of London, Limited, are having a great demand for machines from Winnipeg. They have received a further order from the Stuart-Arbuthnot Machine Company for one 16 h.p. multipolar motor, one 15 h.p. multipolar moter, and one 8 h.p. bipolar motor.

Messrs. R. & W. Conroy, Ottawa, Ont., are installing a large transmission plant at Deschenes Falls, P. Q., for the purpose of furnishing electric power to the E. B. Eddy Company and others. Their electrical equipment consists of two 800 kilowatt revolving field three phase generators, wound for a potential of 10,500 volts E.M.F.; the current is transmitted a distance of 6 miles to Hull, where it is transformed to a potential of 400 volts through step-down transformers of the oil cooled type, all the electrical apparatus being furnished by the Canadian General Electric Company.

Lord's
TRADE Boiler MARK
Compounds

Your Boiler is the Life of Your Establishment; therefore Protect it.

The Largest in the World.

We are occupying our new Factory, which in the largest Chemical Plant in the world devoted exclusively to the manufacture of Water Purifying Chemicals. Our goods not only keep many Boilers clean, but in a safe and reliable condition.

ARE YOURS AMONG THEM? If not, send us a sample of your Boiler scale for analysis and we will make you a report free of charge.

DAVID SLEETH, 13 St. John Street,
MONTREAL.
Sole Agent for Canada.

PHONE MAIN 1150.

Ness, McLaren & Bate
SUCCESSORS TO T. W. NESS & CO.
MANUFACTURERS OF
TELEPHONES AND ELECTRICAL SUPPLIES.
NESS McLAREN & BATE
MONTREAL

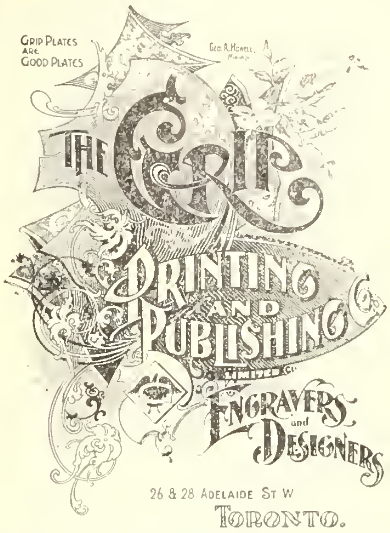
The McLean Publishing Company, Toronto, have ordered from the Electrical Construction Company, of London, Limited, one slow speed press motor to be direct belted to printing press.

FOR SALE

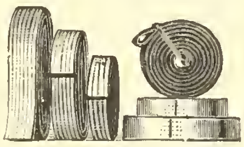
One Wheatstone Bridge Testing Set, with batteries, manufactured by the E. S. Greeley Co., New York. Will test from one thousandth part of an ohm to one million ohms. The instrument is practically new. Price, $82.00. Apply to

CHAS. JAMES,
12-16 Mary St., Hamilton, Ont.

The New System OF EDUCATION
Electrical Engineering
Mechanical, Steam Civil and Mining Engineering; Architecture; Drawing; Surveying; Chemistry; Shorthand; Book-keeping and English Branches
TAUGHT BY MAIL.
Over 50 Courses.
We have helped thousands to better positions and salaries. Send for free circulars, stating the subject in which you are interested.
THE INTERNATIONAL CORRESPONDENCE SCHOOLS,
Box 1004, Scranton, Pa.



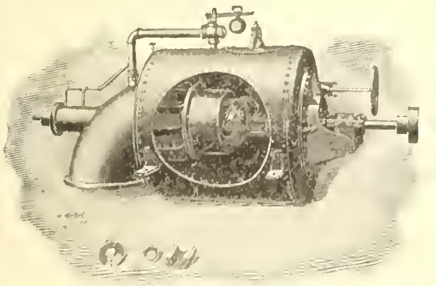
Grip Plates are Good Plates
Geo. A. Howell
THE GRIP PRINTING AND PUBLISHING Co. Limited
ENGRAVERS and DESIGNERS
26 & 28 Adelaide St W
TORONTO.



An' it's BELTS, BELTS, BELTS.—R. Kipling.

F. E. DIXON & CO.
Oak Tanned
Leather Belting
The Strongest, Heaviest, and Best Belting in the Dominion
AGENTS FOR S. E. NORRIS & CO.
LONDON - ENGLAND
Established 1775.
30 Wellington Street East, TORONTO, ONT.
Send for Price Lists and Discounts.

Practically Stretchless
Strong
Fibre
Canadian Oak Belting Co.
MONTREAL
Lace Leather
Satisfaction Guaranteed
Write for Prices
Pure Oak Tanned Leather Belting



THE
Crocker Improved Turbine
In Horizontal Setting, with Quarter Turn Elbow.

Where the nature of the location will permit its use this type has many advantages. It is very suitable for direct connection to dynamos, and many are in operation in this class of service.

Notice how complete and compact this arrangement is, and how easily it may be installed. Can you use anything of this kind? Your inquiries will receive prompt attention.

Water Powers examined and Reports made.
Estimates submitted for Complete Equipments.

The JENCKES MACHINE CO.,
Lansdowne St., Sherbrooke, Que.

VICTOR TURBINES
OPERATING DYNAMOS

That there are more Victor Turbines in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.

FEATURES WORTH REMEMBERING
High Speed, Close Regulation, Great Capacity, High Efficiency, Perfect Cylinder Gate, Steady Motion.

RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Quebec Railway, Light & Power Co., Quebec, 4,000 h.p.; The Ottawa Electric Co., Ottawa, Ont., 2,000 h.p.

CORRESPONDENCE SOLICITED

THE
Stilwell-Bierce & Smith-Vaile Co.
78 Lehman Street,
DAYTON, OHIO, U. S. A.

SPARKS.

The electric light plant at Farnham, Que., will be sold by the sheriff.

Incorporation has been granted to the Renfrew Power Company, Limited, with a capital of $50,000.

The McLachlan Electric & Gasoline Motor Company have removed to new premises at 115 Bay street, Toronto.

The premises of McDonald Bros., electrical contractors, Winnipeg, Man., were recently damaged by fire to the extent of $5,000.

The Leamington Electric Light Company have just put in a new 1,500 light dynamo, furnished by the Canadian General Electric Company.

A company has been formed at Ottawa for the manufacture of automobiles. Messrs. John Sutherland and J. Carling Kelly are the promoters.

W. H. Meldrum, of Peterboro, has just recently installed a 20 h.p. three phase induction motor purchased from the Canadian General Electric Company.

Wm. Clark, a lineman in the employ of the Winnipeg Street Railway Company, recently came in contact with a live wire and was electrocuted.

The Canadian General Electric Company have recently installed one of their standard 120 k.w. single phase alternators for the Chesley Electric Light Company.

The ratepayers of Cannington, Ont., have voted against the purchase of the Dobson electric light plant which it was proposed to operate as a municipal concern.

The Shawinigan Water & Power Company, of Montreal, have purchased a 75 k.w. multipolar 125 volt generator from the Canadian General Electric Company.

The Montreal Automobile Company have made application for a Dominion charter, with a capitalization of $250,000. Messrs. Emile Lepage and J. W. Faucher are interested.

The Canadian General Electric Company are installing one of their standard 150 kilowatt three phase revolving field alternators for the Hanover Electric Light Company. The order covers the furnishing of several induction motors and a complete installation of series alternating arc lamps, with constant current automatic regulating transformer.

The council of Newmarket, Ont., are in favor of spending about $10,000 to increase the electric light and water works plants, and the ratepayers will be asked to sanction the outlay.

The Hamilton Motor Company, of Peterborough, Ont., has been incorporated, to manufacture electric and gasoline motors. The directors include T. A. Colley, W. J. Hamilton and J. W. Bennett.

The ratepayers of Dartmouth, N. S., recently rejected a recommendation of the town council that the plant and franchise of the Dartmouth Electric Light Company be purchased for the sum of $25,000.

A company has been formed, known as the Gasoline Engine Company of Torônto Junction, to manufacture gasoline engines. Recently authority was obtained to increase the capital stock to $50,000.

The ratepayers of Bracebridge, Ont., are evidently progressive, as by a vote of 72 to 5 they expressed themselves in favor of raising the sum of $27,000 for the purpose of extending and improving the electric light plant.

The Richelieu & Ontario Navigation Company have equipped two of their new boats with 30 kilowatt direct current generators direct driven by "Ideal" engines, all of which were purchased by the Canadian General Electric Company.

The corporation at Hespeler, Ont., have purchased the electric light plant of J. S. Shantz for the sum of $2,800, which does not include the boiler and engine. The town will install an incandescent system in connection with the present arc plant.

The Canadian General Electric Company are supplying Mr. J. A. Williams, of Dawson City, Alaska, with a complete electric plant, consisting of one standard 200 k.w. revolving filed three phase alternator, on 50 h.p. and one 10 h.p. induction motor, together with all transformers and electrical supplies required. This plant will be in operation very shortly and the indications are that Mr. Williams' enterprise will be a very successful one.

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SPARKS.

An electric railway may be built between Brighton and Havelock, Ont.

The Guelph Street Railway carried 25,000 more passengers during the last fiscal year than in the preceding one.

The Hamilton, Grimsby & Beamsville Railway Company has made a proposition to build a spur line from Grimsby to the G. T. R. line. This would be of great benefit to the fruit growers in the vicinity.

The Ottawa Electric Railway Company have placed an order with the Ottawa Car Works for eight new cars. The Niagara, St. Catharines & Toronto Railway Company have placed an order with the same firm for four 15-bench open cars.

The Massey-Harris Company have just placed an order with the Canadian General Electric Company for one of their standard 75 kilowatt direct driven direct current generators. This is to be used for furnishing light and power in their Brantford works.

The Cataract Power Compony have submitted a new proposition to the civic authorities of Hamilton in connection with the construction of an electric railway to Galt and Guelph. With the connections proposed it is claimed that the city would be brought into touch with 100,000 persons through an hourly service.

The St. Thomas Street Railway Company have been operating the road at a loss of $6,177.02 for the past two years. It is probable that the road will be handed over to the mortgagees.

The R. Forbes Co., of Hespeler, Ont., have in the remodelling of their mills decided to use electric power throughout, for driving the different lines of shafting. For this purpose they have placed and order with the Canadian General Electric Company for one of their standard 200 kilowatt revolving field three phase alternators, together with generator and feeder panels and a full complement of three phase induction motors.

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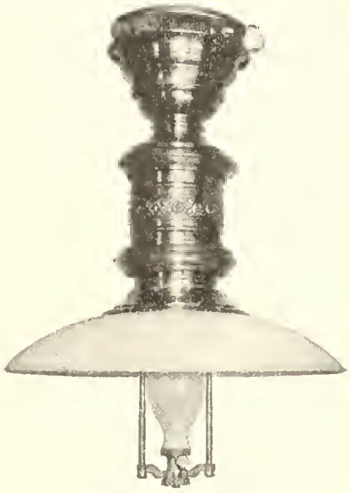

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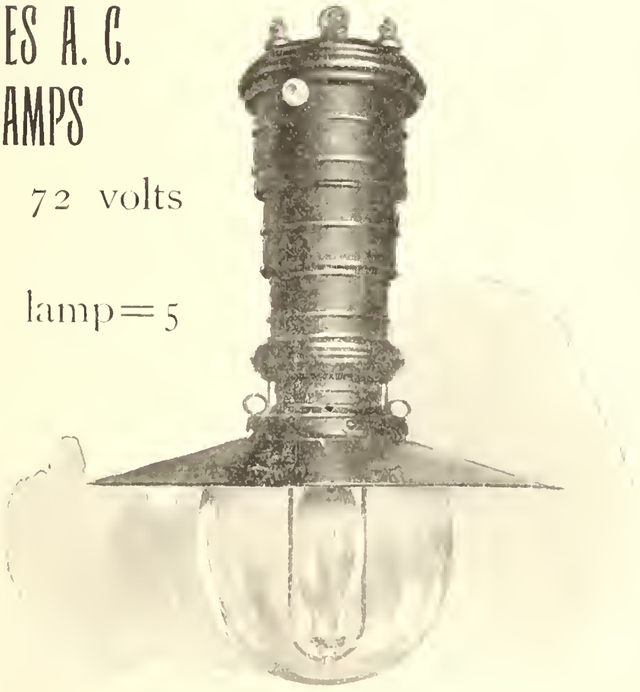

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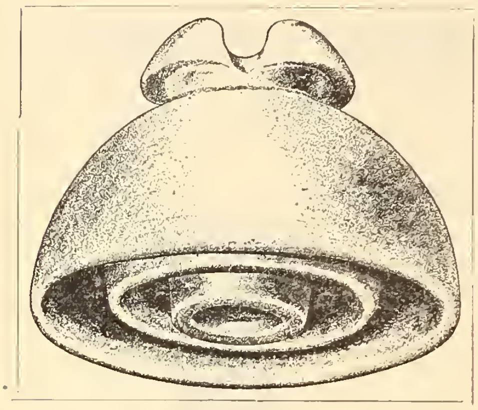

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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N. Y. Evening Post, Oct. 9 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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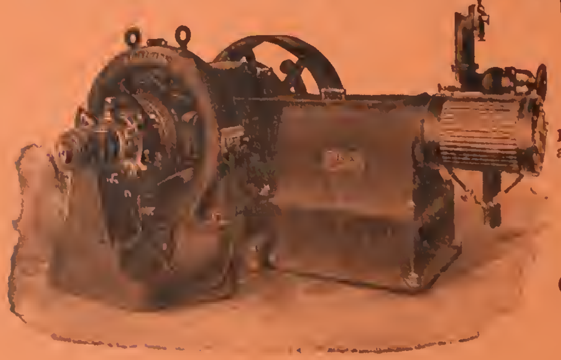

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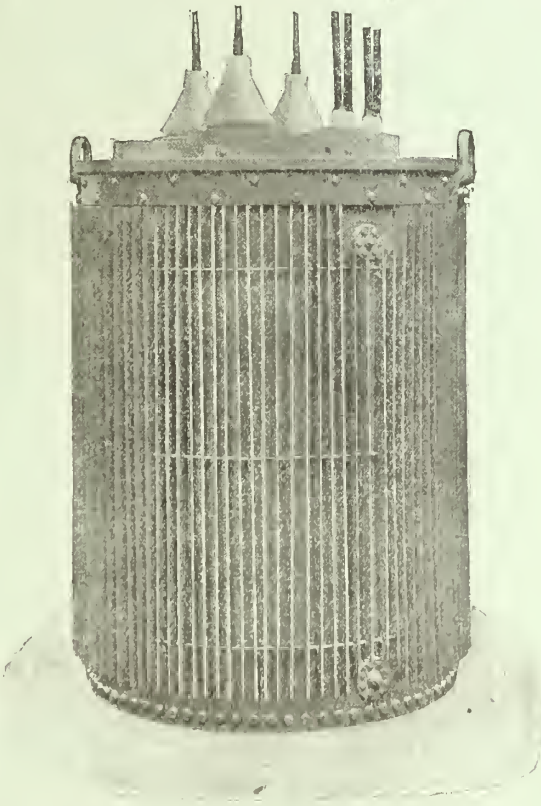

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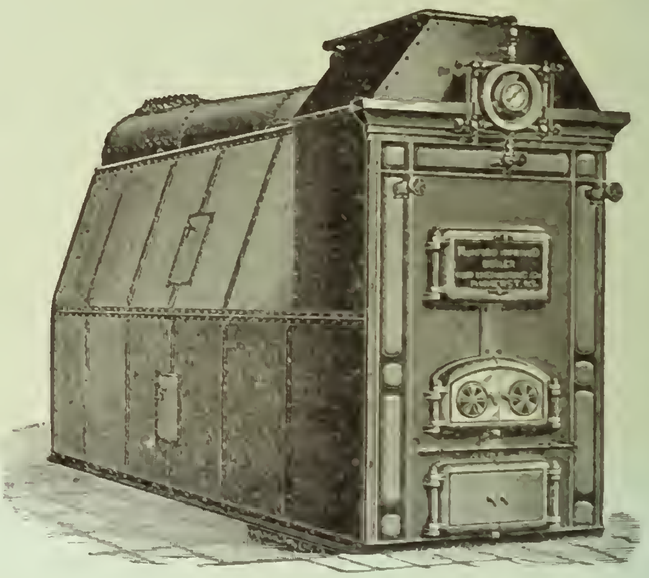

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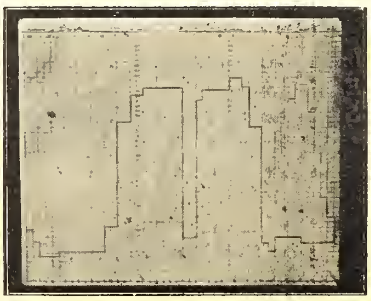

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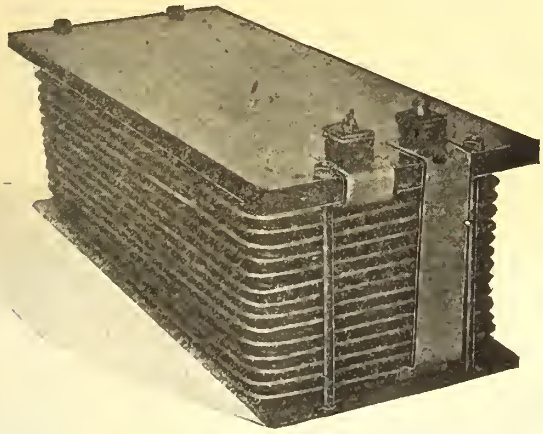

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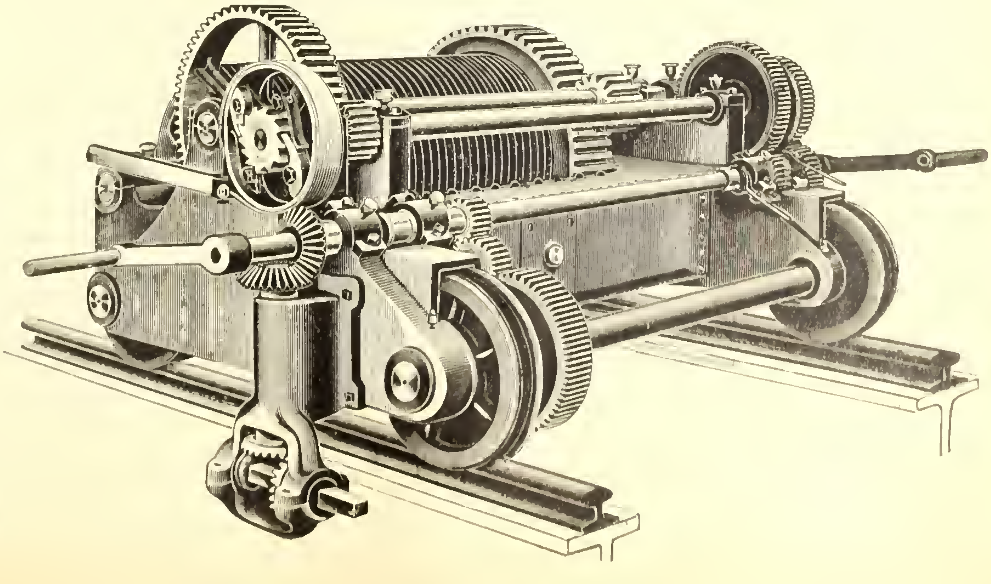

PERSONAL.

Mr. J. H. Walker, of Kincardine, has been appointed engineer at the pumping station at Berlin, Ont.

Tenders are invited up to September 10th for lighting the streets of Millbrook, Ont., with incandescent or arc lamps. Particulars may be obtained from Mr. Turner, village clerk.

Mr. W. D. V. Earl, local manager of the Bell Telephone Company at Brockville, Ont., was recently married to Miss Moody, of Terrebonne, Quebec.

Mr. J. W. Marr, late chief engineer for the Metropolitan Railway Company, has been engaged as traveller for the Steam Specialty Company, of Toronto.

It is said that Mr. Wilfrid Phillips, manager of the Niagara Falls Park and River Railway, has been offered the management of the Winnipeg street railway system, and that he is likely to accept it.

Mr. W. G. Eddington, of Toronto, has been appointed superintendent of the electric light plant owned by the town of Weston, Ont. This plant is meeting with considerable success, and a large number of houses and street lights have been installed. The NEWS wishes Mr. Eddington success in his new position.

In our September issue it was stated that Mr. R. R. Wiley, E.E., had recently joined the staff of the Packard Electric Co., of St. Catharines, as meter expert. By a typograpical error in the item, it appeared that Mr. Duncan, of the Siemens-Halske Company, was also associated with the Packard Company. The statement intended to have been made was that Mr. Wiley had been associated with Mr. Scheeffer, of the Diamond Meter Company, and Mr. Duncan, the well known meter inventor now attached to the staff of the Siemens-Halske Company. Mr. Wiley will have charge of the meter department of the Packard Electric Company.

Mr. J. Ames, superintendent of construction in the long distance department of the Bell Telephone Company, is at present engaged on the construction of the Minnedosa and Neepawa branch. The long distance lines now reach from Winnipeg to Portage la Prairie, Brandon, Neepawa, etc.

SPARKS.

The village council of Morrisburg, Ont., have invited tenders for the installation of an electric lighting and power plant. The plant will be operated by water power.

The Kootenay Electric Supply & Construction Company, of Kaslo, B.C., have installed an electric light plant in a new steamer for the Kootenay River and Navigation Company.

The town of Napanee, Ont., is about to install an electric fire alarm system, for which tenders close September the 15th. John Carson is chairman of the Fire, Water, and Light Committee.

It is understood that the Galt, Preston and Hespeler electric railway has passed into the control of the Hamilton Electric Light & Cataract Power Company, and that extensions to the road will be made.

The Hinton Electric Company, of Victoria, B.C., recently secured a contract to supply the Le Roi mine at Rossland, B.C., with a hoist and other apparatus, the cost of which will be about $20,000.

The corporation of Niagara Falls, Ont., have decided to purchase another transformer, so that additional power may be furnished for operating the works of the Ontario Silver Company.

Mr. P. R. Colpitt, city electrician, of Halifax, N.S., has submitted to the town authorities of Charlottetown, P.E.I., an estimate of the cost of installing an electric light plant. His figure is $15,387.50, exclusive of power house and foundations for engine and generators, which would bring the cost up to $20,000 for a complete plant. A special committee has been appointed to report further on the matter.

The annual meeting of the Parry Sound Electric Light Company, of Parry Sound, Ont., was held a fortnight ago, at which a most satisfactory report was presented. The report stated that the plant is to be doubled, and steam power adopted. An annual dividend of 8 per cent. was declared, and the following directors elected:—President, E. J. Vincent; Vice-President, Sheriff Armstrong; Secretary-Treasurer, J. W. Easton. Directors—E. J. Vincent, Sheriff Armstrong, Capt. Macfarlane, J. F. Moseley, W. B. W. Armstrong, E. Pirie, and Judge McCurry.

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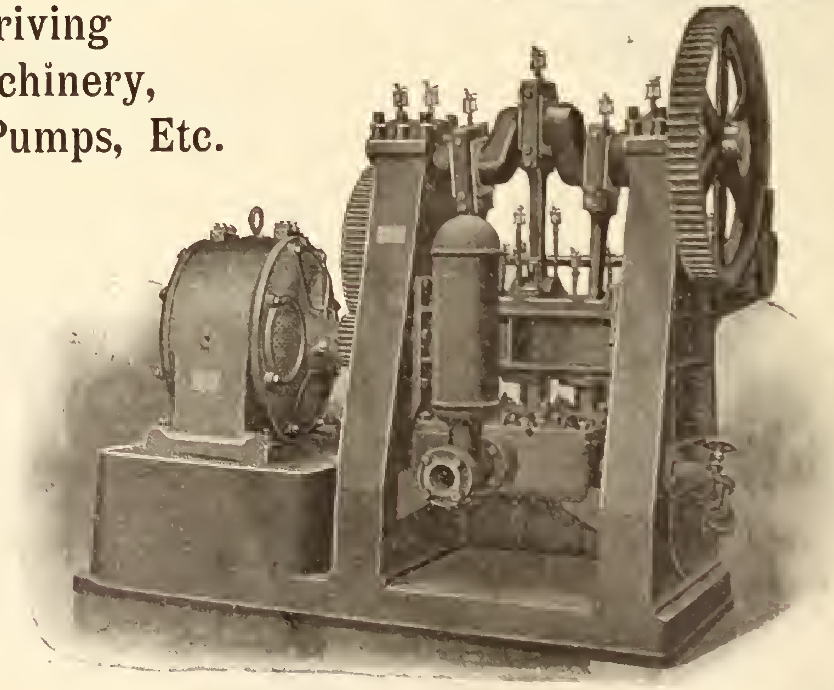

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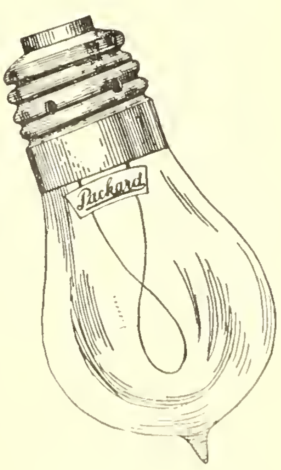

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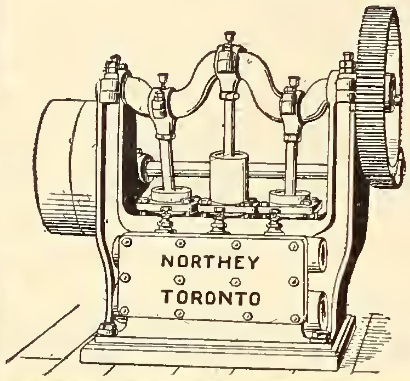

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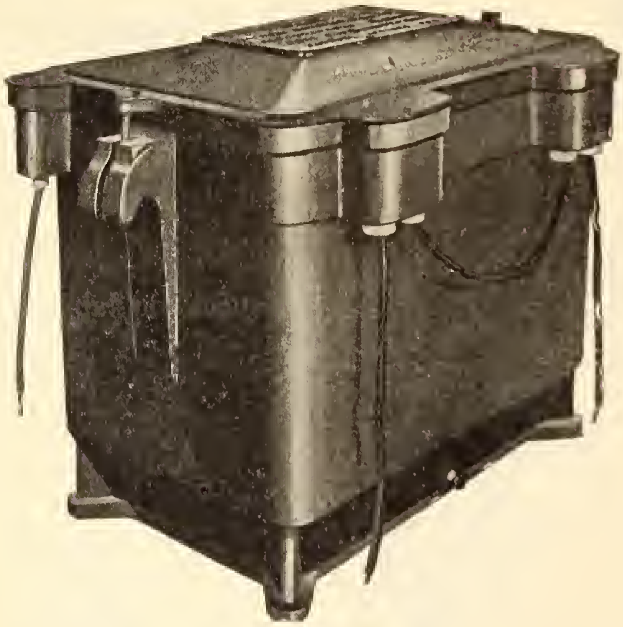

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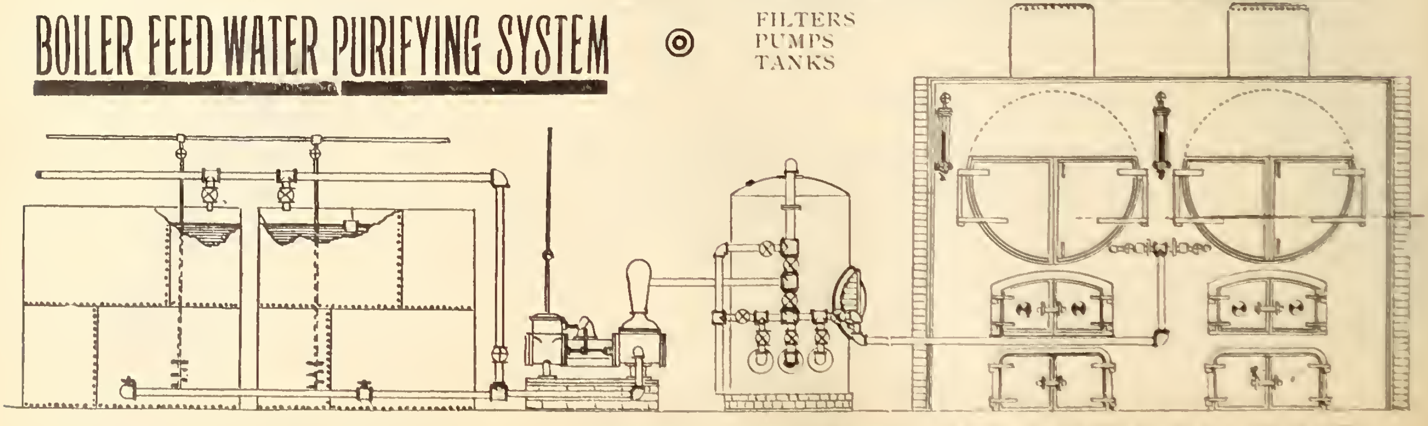

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CANADIAN
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VOL. X. SEPTEMBER, 1900 No. 9.

MR. D. E. BLAIR.

THOSE who attended the recent convention of the Canadian Electrical Association will recognize in the accompanying portrait the features of Mr. D. E. Blair, B. Sc., the author of that interesting paper pertaining to the operation of the electric railway in the city of Quebec. Although only twenty-three years of age, Mr. Blair is well versed on the subject of electric railway operation. He graduated from the High School in the year 1893, when he entered the Science Department of McGill University, graduating with the degree of Bachelor of Science in the spring of 1897. In August of that year he was engaged as assistant electrician for the Quebec District Railway Company, and in the following year became chief electrician. In the fall of 1898 this company was amalgamated with the Quebec, Montmorency & Charlevoix Railway Company and the Montmorency Power Company under the name of the Quebec Railway, Light & Power Company, and since that time Mr. Blair has acted in the capacity of chief electrician of the railway division of the amalgamated interests. His paper, read before the Canadian Electrical Association, and which appears in this issue, is one of exceptional value, and was much appreciated by the members.

MR. D. E. BLAIR.

CHAMBLY POWER FOR MONTREAL STREET RAILWAY.

THE Montreal Street Railway Company have entered into a contract with the Chambly Power Company under which the latter agrees to supply the former with 5,000 h.p. continuous current, day and night, every day in the week, for twenty-three years, at $25 per h.p. per annum. The arrangement is no doubt in the interest of the street railway company, as it saves a large outlay for additional plant, in the shape of engines, boilers, machinery, buildings, etc., their present power plant being fully loaded. Again, it is good for the Chambly Company, who run by water power, use large units, and are really in need of a load, more especially if the contemplated new dam is gone on with.

There was opposition to the contract by some of the directors of the Street Railway Company, but, luckily, the manager, Mr. Wanklyn, is a practical man, thoroughly up in the business, and he managed to get a proper view of things taken, and the scheme was ratified.

The contract aggregates, in twenty-three years, $2,875,000. At the meeting of the Street Railway Company, Mr. Wanklyn explained that at the present time the Montreal Street Railway was laboring under the disadvantage of not having any reserve of power. It would cost the company at least $650,000 to build the necessary reserve steam plant, and he considered the contract before the shareholders the most advantageous arrangement which they were able to make. On a winter's day at present the railway needed nearly 1,000 horse power, and he expected that in two years' time they would require another 5,000 horse power from the Shawinigan or any other company which could furnish it to the best advantage. Mr. Boas stated that the Shawinigan Company would put the power in at from $20 to $22 per horse power per year. To this Senator Forget remarked that as a director of the Shawinigan Company he was in a position to say that they were not ready to supply power. In answer to some questions, Mr. Wanklyn explained that it would take about 7,100 horse power alternating current at Chambly to deliver 5,000 continuous current to Montreal. The relative cost of the alternating and continuons currents is $25 to $32 per horse power. The Royal Electric Company had been contracted with to supply 500 horse power alternating current, as a temporary relief, for $35 per horse power, which was equivalent to $42 continuous current. Mr. James Ross, the vice-president of the company, thought the Street Railway Company was making an excellent bargain. He had visited different western cities, had seen all the latest improvements in electrical power, had gone over the works of the Niagara Company, which is getting $35 and $36 per horse for its power, and he had come to the conclusion that the Street Railway Company was making the best bargain possible.

The Wm. Sutton Compound Company, of Queen street east, Toronto, had an attractive display of engineers' supplies in the machinery hall at the Toronto Exhibition. They included boiler compound, lubricating oil, cotton waste, pipe covering, asbestos goods, etc. The company report a steadily increasing trade in these lines.

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Canadian Electrical Association.

THE annual convention of the Association held in Kingston at the close of last month was, perhaps, quite as successful, all things considered, as could have been anticipated. The change in place and date of the meeting made necessary by the Ottawa fire, the absence of some of the members on vacation, and the necessary attendance of others at the Toronto Exhibition, were important factors militating against a good attendance and a successful meeting. Keeping in mind these drawbacks the attendance was satisfactory. The papers were of a high order, but in some instances evoked less discussion than their merits entitled them to. The late date at which the manuscripts reached the committee made it impossible to have the papers printed and distributed to the members in advance of the meeting. To this was largely due the lack of discussion, especially on some of the more highly technical papers. Authors would do well to remember that if their papers are to receive proper attention at these conventions they must be completed sufficiently in advance of the meetings to permit of their being carefully read and digested by the members. Seeing that an important object of most of the papers presented at meetings of this kind is to provoke discussion, and that the points brought out by the discussion are in many instances quite as valuable as those contained in the paper itself, every effort should be made to ensure as full discussion as possible by the members of the papers which may be presented at future conventions. To this end it is incumbent upon the Association to allow ample time for the preparation of papers, and upon those who may undertake their preparation to complete their task at least a month in advance of the meeting at which they are to be presented.

In the President's address and the reports of the various committees there is to be found evidence of useful work acccomplished by the Association in the past, as well as a determination to broaden to the greatest possible extent the scope of its influence in the future for the development and protection of electrical interests in Canada. Special emphasis should be placed upon the value of its work in securing the legislation contained in the Conmee Bill, under which the interests of electric lighting companies in their relation to the municipalities are safeguarded. This measure has already proved of inestimable value to several companies whose property has, thanks to its provisions, recently been taken over by the municipalities at a fair valuation. Had this measure not been placed on the statute books, largely through the efforts of the Legislation Committee of the Canadian Electrical Association, these and all other private lighting companies would have been completely at the mercy of the municipalities. In view of what it has done for them, the Association has the strongest possible claim to the friendship and support of electric lighting companies in Ontario. All such companies should show their appreciation by becoming identified with the Association and its work. Mention was made at the Kingston convention that the Electric Light Association of the United States had recently sent out letters to lighting companies in Canada soliciting them to become members of that organization. Apart from the fact that membership in the National Association costs $25 per year, while in the Canadian Association the cost is only the nominal fee of $3 per year, the Canadian organization can benefit the electric lighting companies of Canada in many directions—notably as regards legislation, municipal, provincial or federal—to a much greater degree than could an alien society. An important concession was obtained last year by the Association from the Inland Revenue department of the Dominion government by which in future the charge for reinspection of defective meters will be only fifty cents.

There is ample scope in these and other directions for useful effort by the Association in behalf of the electrical interests—not to speak of the benefits accruing from the reading and discussion of valuable papers such as are presented at the annual conventions. This year a new departure was made by inviting manufacturers and dealers in electrical and kindred supplies to send exhibits to the convention, necessary space, current and labor for the purpose being provided without charge by the city council and local electric companies of Kingston. Doubtless this will prove to be an interesting feature of future conventions.

Too much cannot be said in praise of the cordial hospitality extended by the Mayor and Corporation, the local electrical companies and the citizens of Kingston to the members of the Association in attendance at the convention. The decision to hold next year's convention at Ottawa and the re-election of the President and other executive officers will no doubt meet with the approval of the entire membership. Steps are to be taken to materially increase, during the coming year, the already large membership of the Association, and to push vigorously forward all departments of its work.

CANADIAN ELECTRICAL ASSOCIATION

PROCEEDINGS OF THE TENTH CONVENTION

THE Tenth Annual Convention of the Canadian Electrical Association was held in the City Hall, Kingston, Ont., on Wednesday, Thursday and Friday, August 29th, 30th and 31st. The first session opened at 10 a.m., the president of the Association, Mr. A. A. Dion, of Ottawa, being in the chair.

The following members were in attendance :

W. H. Warrington, A. M. Wickens, T. F. Dryden, J. A. Kammerer, A. C. McDonald, J. J. Wright, H. Gearing, A. B. Smith, J. Raymond, E. B. Biggar, C. H. Mortimer, Toronto ; F. H. Leonard, jr., W. J. Plews, W. B. Powell, Wm. H. Browne, P. G. Gossler, H. O. Edwards, A. L. Mudge, N. C. Ross, Cecil Doutre, Wm. H. Winter, F. Wilson Fairman, K. B. Thornton, A. G. Grier, R. M. Wilson, Geo. H. Olney, L. A. Herdt, Thomas Rogers, D. Sleeth, Ed. Brown, J. P. Thomson, R. E. T. Pringle, R. S. Kelsch, A. C. McDonald, Montreal ; A. A. Dion, W. G. Bradley, Wm. Ahearn, jr., J. M. Leamy, W. S. Hodgins, D. R. Street, Ottawa ; H. R. Leyden, Gordon J. Henderson, F. W. Martin, Wm. A. Turbayne, Hamilton ; A. A. Folger, E. Moore, Geo. H. Dickson, J. Halliday, F. Simmons, E. Ashley, R. White, R. Boyd, jr., H. C. Nickle, I. H. Breck, Thomas Donnelly, Kingston ; A. L. Briethaupt, J. E. Bilger, Berlin, Ont.; W. W. Williams, Geo. Shand, Sarnia, Ont.; B. F. Reesor, Lindsay, Ont.; J. F. H. Wyse, Brantford, Ont.; E. E. Cary, George A. Powell, St. Catharines, Ont.; J. W. Purcell, Walkerville, Ont.; John Yule, Guelph, Ont.; A. Sangster, Sherbrooke, Que.; D. E. Blair, Edward Slade, Quebec, Que.; L. A. Somers, Halifax, N.S.; P. H. Houer and Geo. M. de Ginther, New York.

The President called the convention to order and stated that the first item on the programme was the address of welcome from the Mayor and Aldermen of the city of Kingston. He said : I have much pleasure in introducing the mayor and some of the members of the city council who have been kind enough to come and greet us this morning.

Mayor J. A. Minnes, on rising to speak, was greeted with applause, and said : Mr. President and Gentlemen of the Canadian Electrical Association : It gives me, on behalf of my colleagues of the city council and the citizens of Kingston generally, the greatest of pleasure to extend to you a most cordial and hearty welcome to this good old historic city. Let me assure you, we appreciate the honor you have done this city and done us in holding this convention here. I trust your deliberations may be productive of very much good to your Association, that your visit may be a very pleasant one, and that you will be able to carry away with you a very pleasant recollection of your stay in Kingston. Referring more especially to the object of your gathering, let me say that, in my mind, it is fraught with the greatest possible interest to the welfare of mankind. There is no subject of more vital importance or of greater moment than the study of that subtle and silent force with which your labors are connected. Of the abstruse quality of that power, what it is, whence it comes and whither it goes, I will not attempt to speak, but let me congratulate you, Mr. President and Gentlemen, on the splendid strides and rapid advancement electricity has made, more especially in its application to the good of humanity. This may truly be said to be a progressive age, that the object of all our energy is to make the powers of nature, seen and unseen, minister to the wants of man, his progress, welfare and happiness. In the industrial application of the electrical current we have reached a position never before dreamed of by any previous generation. It is an important factor in our transportation, it moves the great wheels of commerce, it gives the traveller the light, and affords light, heat and comfort to all men. In the Roentgen ray the unseen parts of the body are brought to view, thereby proving a valuable adjunct to medical sciences. In fact, in the whole complex system of modern civilization it proves an important factor. I congratulate you that your labors are in such a field. I trust that through your deliberations benefits heretofore undiscovered may be brought forth, and I trust that your convention in Kingston may prove of very much good to your Association and to mankind in general. I extend to you the freedom of the city. Accept it from my hands, and I trust your stay will be a most pleasant one. (Applause.)

Ald. Donnelly, in following the Mayor, said : As a member of the City Council, I desire to supplement the remarks of our Mayor in regard to the kind invitation that he has given to you this morning. We cannot offer you any of the very great advantages that you will find in the larger cities in Canada, but we point with a great deal of pride to the historical record of Kingston and to the physical advantages which you see on every hand. Kingston is beautifully situated. You will find it of great interest to visit our educational institutions, to notice the great harbor that we have here, boating facilities, the works that the Militia Department in the old days have erected here for the defence of the city, and we trust you will find enough interest in the city to warrant your coming back here in the near future. At any rate, we will endeavor to do our best to make it as pleasant for you as we possibly can. As the Mayor has very truly said, yours is a very noble vocation indeed. To harness and control the powers of electricity is something that must be of great interest to mankind ; and you in your deliberations and advice one with the other will be able greatly to assist along the lines of this work. I can assure you that anyone who notices what vast strides electricity has made in the last few years cannot help but be amazed when they notice it. Why, it is only the other day, looking at some of the reports of the United States, I noticed that at the present time the electrical plants of the United States somewhat over 3000 plants represent a value of three hundred millions of dollars. That is a wonderful record, indeed, when we take into consideration that it has only arisen in the past few years, you might say. As one of the Council of the city, I will do all that I can to make your visit a pleasant one. The Mayor has told us that your labors have been of great advantage to mankind. You have, it seems to me, in a greater degree than any other body of men carried out the scriptural injunction which we find very early in the bible, when the Lord said " Let there be light, and there was light." (Applause). I hope and trust that your deliberations will be of great benefit to yourselves and to mankind, and I know they cannot help but result in all that is beneficial to electrical interests on this continent.

The President : I have much pleasure in calling upon the President of the Board of Trade to address a few words to you.

Mr. E. J. B. Pense : Mr. President, I can assure you, on behalf of the mercantile interests of Kingston, that we heartily endorse the welcome addressed to you by the Mayor and by Ald. Donnelly. I have read somewhere (I think it was in a patent medicine advertisement) that " electricity is life." We have not fully realized it in the city of Kingston yet, because we have not got an electric light on every corner, but we hope next year to make some attempt at a municipal lighting system ; at least, they are all talking that way. I may say, electricity has not been a very strong point in the city of Kingston, but there are points about the old city, and we who have fought for a number of years to get it the recognition it deserves, are very proud indeed to have your convention here, that the people of Ontario may say that the city is a little better than it looks. You will find in the city of Kingston, a city of 20,000 people, greater charities than is found in any other city of its size on the continent of America. You will also see fine churches. We are not given many gifts by rich men, but we have a great university and it is going to be much greater ; instead of being Queen's College it is going to be Queen's University in all that a university implies. In three or four years I hope to see three or four stone buildings upon the campus of Queen's University, and among those buildings I am assured by Principal Grant will be one for the full equipment of an electrical plant. Our mining school, which has struggled along for a few years, is doing the best practical mining work on the continent of America, with the exception of the Michigan school, and they receive a straight grant of $45,000 a year. We are now equipping a laboratory which will be the best by far odds in practical mining in the whole Dominion of Canada ; and I may say to you that it recognizes the generosity with which science is looked upon by all classes and all countries, that nearly every machine in that mining laboratory is a gift from manufacturers, and chiefly from the United States. I can assure you, gentlemen, that although the mercantile interests of Kingston are not very strong, they have the reputation, as you know, of being solid, and that Kingston, while it is not large, is honest to the core, and the merchants of Kingston will reach towards you the glad hand and hope that you will go away from Kingston not only having had a pleasant time, but with a better opinion of its social and business qualities. (Applause).

The President : Mr. Mayor and Gentlemen of the city of Kingston : It is not my purpose to detain you here to listen to a speech of mine, but I desire on behalf of the Canadian Electrical Association to tender to you our very warm thanks for the kindness which you have shown us this morning. We are indebted to you, gentlemen, for coming here to greet us. and for the very kind words of welcome which you have uttered. We are indebted to you in a special manner because I know of no city where the previous conventions of this Association have been held where the municipality has taken such pains to show their hospitality. You have given us the use of your beautiful municipal building, and through your kindness we are enjoying the comforts of this well appointed place. You have done more, sir, you have provided for us an excursion to which we look forward with pleasurable anticipations, and we cannot say too much to express the gratitude which we ought to feel for all you have done for us. When I look upon these beautiful buildings I think it is a privilege to be here. When I look upon the beautiful portraits of the past mayors which adorn the walls of the hall upstairs, when I look upon you, sir, I think it is a privilege for me to occupy this chair, if only for a few moments. We accept with very much pleasure the freedom of the city which you have offered us. We will be very happy to have you attend the sittings of this convention right along. I think by this afternoon the attendance will be very much larger, and you may hear something that will be interesting and profitable to you. The next item on the programme this morning is the reading of the President's address. It seems to be an established custom in this Association that the President should read an annual address. Were it not so I would not inflict upon you this formality, but profiting by the experience I have gained during my year of office, I have put together here a couple of suggestions which will be taken up later by the Association, and thus this address may result in some benefit to the Association.

PRESIDENT'S ADDRESS.

To the Members of the Canadian Electrical Association :

GENTLEMEN:—I extend to you a hearty welcome to this our tenth annual convention. I have looked forward with feelings of keen pleasure to this meeting, where it would be my privilege to greet many old friends, make new ones, and celebrate with them the tenth anniversary of our Association.

Each successive convention increases my faith in the value of our Society from the standpoint of our various business interests as well as that of education—and I trust that this meeting will be as fruitful of good results as any of the preceding nine.

I had cherished the hope of meeting you in my own city of Ottawa, but it had been ordained otherwise. The disastrous conflagration of April 26th which reduced to ashes a large portion of our Capital, rendering thousands homeless and destitute, and destroyed the greater part of the various electrical plants of the city, made it practically impossible to hold the convention as prearranged, and a postponement became necessary at first, and later, to my regret, a change of place.

Let me say here that the value of the friendships formed in this Association was exemplified in a touching manner by the many expressions of sympathy, the prompt and generous offers of assistance received from many of my fellow members.

A formal invitation having been received from the good city of Kingston to hold our 1900 meeting here, the executive committee unanimously decided to accept the proffered hospitality. When you consider the good things provided for our entertainment by the mayor and citizens of this city, and the completeness of the arrangements made by the local committee under the guidance of Mr. F. Simmons, you will agree with me that we have made no mistake in coming here, and that the thanks of this association are due to those who so zealously labored for our comfort and pleasure.

It is a source of gratification to me that our membership continues to increase notwithstanding that a considerable number of members drop out of the association every year. We should put forth our best efforts to prevent, if possible, these annual lapses, and we should not rest satisfied until every electrical operating, manufacturing and supply company firm or individual is represented on the membership roll.

In this consideration I would submit to your earnest consideration whether it would not be well to introduce in our constitution a feature of company membership such as carried out by the National Electric Light Association of the United States in addition to the individual memberships, which could remain open to those who wished to avail themselves of them.

This might be a means of interesting in our work many companies who now take no part in it, although they all receive practical benefit from our labors.

You will be pleased to see by the report of the Secretary-Treasurer that our finances are in a sound and prosperous condition. The revenue up to May 31st last was about $130 in excess of that of the preceeding year, and the cash on hand for the same date was about $330, or more than double the amount on hand on the corresponding date last year. You will observe that this is due largely to the low cost, to the association, of the convention of 1899 as compared with that of 1898.

You will have submitted to you the reports of the various standing committees, and you will realize that all the work of the association is not done at the annual convention. Much has been done during recess and some important results have been obtained.

Those members who have freely given of their time and purse on committee work are entitled to the fullest expression of our appreciation and gratitude. The achievements of the legislative committee during the past year have been of incalculable value to the members of this association. Through the untiring, timely and well directed efforts of this committee the "Conmee Bill," which was in danger of being ruinously amended, was reaffirmed by the Legislature of Ontario, so that this law now bids fair to remain permanently on the Statute books of the province.

This is as it should be. No doubt a careful consideration of this measure has convinced our legislators of the justice of its principles and the wisdom of its provisions. The committee should be continued for the purpose of watching any legislation unjust to electrical interests which may be introduced in our legislatures, and I trust that such calls upon the companies interested which may be required to meet the necessary expenses will be promptly and cheerfully met.

Let me say to those who contributed to the expenses of this committee during past years, that they have received good and full value for their money. The work has been done efficiently and economically.

The report of the committee on meter inspection will show that it also has gained something for electric lighting companies in the reduction of certain inspection fees.

Other committee will report progress.

With regard to the committee on standardization of accounts, I would commend this work to your serious consideration.

If companies could agree on some general plan of distributing operating expenses, and would furnish their figures to some committee of this association, it would be possible to circulate among the members comparative statements of expenses, omitting names and amounts and giving percentages only, which would enable managers to test the economy of their management and apply the pruning knife where necessary. If all companies would agree to make their annual reports of revenue and expenses on the same basis, especially as regards interest, depreciation and charges of that nature, and publish their statements, it would be possible to ascertain the true percentage of net profits in each case, and this would tend to remove from the minds of municipal legislators the impression often prevailing that there are enormous profits in public services such as electric lighting. In this way the ardor of advocates of municipal ownership might be tempered. At any rate it would have an educational value for the ratepayers.

The above considerations were suggested to me by a discussion on this subject which I had the privilege of hearing at the recent convention of the N. E. L. Association, who appointed a strong committee to deal with this question.

Letters have recently been received by electric light companies in Canada from the National Electric Light Association of the United States, urging such companies to join that association, (whose membership fee is $25 per year), in view of the important work being done by it for the benefit of electric light companies.

While that association, which has several Canadian companies on its membership roll, is to be commended for the work it is doing, I must remind Canadian electric light companies that their first duty is to the Canadian Electrical Association, whose work is of more immediate value to them, and which is in greater need of their co-operation and support.

The committee on papers is to be commended for the high character of the papers to be read and discussed at this meeting, and I desire to tender to the distinguished writers, who have given us so freely of their precious time, the thanks of the association. The range of subjects is such as to, I trust, please every member.

It is a matter for congratulation that the electrical industries in Canada generally continue to enjoy a reasonable amount of prosperity.

The past year has been marked by extraordinary activity and progress. Many new and extensive electrical works have been carried out, and everywhere there has been evidenced the greatest confidence in the future success of electrical undertakings. Water powers have been developed and utilized, and electric power transmitted to long distances. Large works and factories hitherto operated by steam have adopted the electric motor in large units. Some steam railways have been converted into trolley lines. Electric railways have been extended far out of cities, equipped with heavier rails, better rolling stock, larger generators, and more powerful motors, and higher speeds have prevailed.

Electric light and power stations have been enlarged and remodelled. In this particular field there has been a decided tendency to install generators of one kind only, and to supply all services therefrom, hence the increasing use of A. C. polyphase motors of the "induction" or "synchronous" type and A. C. arc lamps of the enclosed arc variety, either "series" or "constant potential."

The use of elecricity in mining has also received considerable development, and its application to the manufacture of calcium carbide is beginning to assume large proportions. The large number of small central station installations testifies to the increasing popularity of electric lighting and power. New isolated plants, some of them very considerable, were also very numerous. As a central station man I regret this, but I suppose the manufacturer is happy.

In the telegraph and telephone fields the past year has witnessed important extensions and improvements to existing systems.

Among the many important works of the year the following may be mentioned :

The great water power and electrical developments at Shawinigan Falls and other places on the river St. Maurice, Que.

The Jacques Cartier Water and Power Company, transmitting energy from the falls of the Jacques Cartier river to the city of Quebec for general light and power distribution.

The Canadian Electric Light and Power Company's transmission from the Chaudiere Falls on the river of that name to the town of Levis, Que., for general distribution, with possible future extension to the city of Quebec, opposite, through submarine cables.

The Lunenburg Gas Company, transmitting 100 horse power 8 miles for distribution in Lunenburg, N.S.

The 14 mile transmission of the Lindsay Light, Heat and Power Company, into Lindsay, Ont., recently inaugurated.

Extensions of the Metropolitan Railway, of Toronto, to Newmarket, 30 miles distant. Extensions of the Ottawa electric railway to Britannia on the bay and to the Dominion rifle ranges.

The conversion of the steam railway from Quebec to St. Anne de Beaupre, some 30 miles.

The adoption by the Montreal Street Railway Company of electric power from Chambly, Que.

The installation of several thousand horse power of induction motors by the Dominion Cotton Company for their mills in Montreal, and by other factories in the same place.

The installation by the E. B. Eddy Company, of Hull, Que., of 1500 or more horse power of induction motors, and the building of a power house by Conroy Bros. at Deschenes, Que., five miles away, to supply the power at 10,000 volts.

The 500 horse power plant of the Soulanges canal used for operating the lock gates and for lighting the canal.

The 2,700 horse power generating water power plant of the Bronsons Company at Ottawa, supplying energy for the manufacture of calcium carbide to the Ottawa Carbide Company.

The extension of the government telegraph system in the Yukon district, 600 miles, and along the north shore of the lower St. Lawrence river, for 300 miles down to Labrador.

The substitution of storage batteries and dynamos for chemical batteries in the plants of the G. N. W. and C. P. R. telegraph companies at several places.

The complete renewal of the Bell Telephone Company's plant at Ottawa, introducing the "central energy" system. The complete reconstruction of their lines there and in other places, and the extension of their long distance system in all directions.

To this list, made mostly from memory, many other important works and undertakings could be added.

The pleasing features of all these undertakings, from an engineering point of view, is the generally scientific design and modern character of the apparatus and works.

I thank you for the confidence you reposed in me when you raised me to the presidency of this Association. I have conscientiously tried to further your interests during the year, and I am indebted to other officers and members of the Executive Committee for the assistance they rendered me at all times. I desire to make special mention of our secretary-treasurer, who was ever cheerful and willing to do everything I asked him to do, although I know I exacted much of him at times. The relations between the members of the executive have been very pleasant and harmonious, and I trust the same harmony and good feeling will characterize the proceedings of the convention, and that when you return to your homes you will, each one of you, bear away the most pleasant memories of the 10th convention of the C. E. A., the good city of Kingston and its citizens. I wish you all continued prosperity and success in your various spheres.

Mr. C. H. Mortimer read his report as Secretary-Treasurer, which was as follows :

SECRETARY TREASURER'S REPORT.

The membership of the Association has somewhat increased during the year, notwithstanding the removal of a number of names of members who resigned, and of others who changed their place of residence without notifying the Secretary. It perhaps cannot be expected that the membership should increase in the same ratio as in the past, yet there is still large room for expansion if all who should be interested in the work of the Association would connect themselves with it. For example, there are many electric lighting companies who co-operated in the work of the Legislation Committee, but are not yet represented on the membership of the Association. If possible, means should be found to enroll them and obtain their active co-operation in the various departments of the Association's work.

In several of my previous reports I have referred to the refusal of some members to pay accounts of past due fees, on the ground that they joined the Association for one year only. I am still confronted with this difficulty. Under present circumstances it is difficult to know who can be safely counted as members, or what amount of the outstanding fees can be regarded as collectable. I would suggest that the form of application for membership be changed, so as to provide that persons who may join the Association shall assume liability for payment of fees until their resignations have been tendered and accepted.

The number of members at present on the roll is as follows : Active, 213 ; Associate, 31 ; total, 244 ; a gain of 3 since last report.

Three meetings of the Executive Committee were held during the year, viz., on September 14th, 1899, February 10th and July 26th, 1900.

At the first of these, held at the Russell House, Ottawa, Mr. J. Gordon Henderson, Secretary of the Local Entertainment Committee in connection with the Hamilton convention, reported that the account for expenses incurred by the local committee, after having been audited by Messrs. Black and Leyden, had been paid, the balance above $100 contributed by the Association having been obtained by voluntary subscriptions.

The Secretary Treasurer reported funds on hand to the amount of $271.00. Accounts for printing and engraving, in connection with the last convention, amounting to $96.90, were ordered to be paid. The work of the various special committees was discussed, and the Secretary directed to write the chairman of these committees requesting them to call meetings at an early date to consider and prosecute their work. The Secretary was also instructed to request the members of the Association to suggest topics for papers for this convention.

At the second meeting, held at the Russell House, Ottawa, on February 10th, a number of letters were read from members suggesting topics for papers. The Secretary was directed to acknowledge receipt of a letter from Mr. E. Mascart, inviting the Association to send a representative to the International Electrical Congress of 1900 at Paris. Messrs. Street, Gossler, Higman, Cary and the Secretary were appointed a Committee on Papers for this convention. To this committee were referred the suggestions received from members regarding suitable topics. It was decided that Mr. Wallhank be invited to submit a paper on "Meter Inspection," and Messrs. Keely and Higman to prepare a public demonstration of Wireless Telegraphy. The Secretary was directed to send accounts to members in arrears for fees, giving them notice of draft if the amount should not be paid within ten days. A large local committee was appointed to make all necessary arrangements for the convention, and the sum of $150 was voted for the use of this committee. It was resolved that the annual convention be held at Ottawa on the 27th, 28th, and 29th of June, 1900.

Owing to the disastrous fire which occurred in Ottawa shortly after this executive meeting, it was found necessary to postpone the convention until September, which was done with the unanimous consent of the Executive Committee, and the members notified accordingly. Subsequently a cordial invitation was received from the Mayor and citizens of Kingston to hold the convention in that city, which invitation was accepted by the Executive Committee at a meeting held in Toronto on July 26th last, with the approval of the President and other members resident in Ottawa. The 29th, 30th and 31st of August were selected as the dates for the convention. The President and Mr. A. B. Smith were appointed a committee to assist in making the local arrangements. One hundred dollars was voted towards the expenses of the local committee. The Secretary was directed to notify manufacturers and dealers in electrical supplies that free accommodation would be provided during the convention for exhibits, also labor and current free for installing and operating same. The Secretary was authorized to procure the services of a stenographer to report the proceedings of the convention. Five persons were elected to active membership in the Association, and several resignations accepted. In the case of members in arrears for fees the Secretary was directed to notify them that their resignations could not be accepted until all indebtedness to the Association is liquidated.

Following is a statement of the receipts and disbursements :

FINANCIAL REPORT FROM JUNE 1ST, 1899, TO 31ST MAY, 1900.

RECEIPTS.

Cash in bank June 1st, 1899	$137.76	
Cash on hand June 1st, 1899	17.85	
194 Active Members' fees at $3.00	582.00	
21 Associate Members' fees at $2.00	42.00	
50 copies Convention report	5.00	
Exchange on Cheque	.25	
		$799.64

DISBURSEMENTS.

Expenses of Convention :		
Grant to Local Committee	$100.00	
Geo. Angus, Stenographer	26.00	
C. R. Lane (Assistant to Secretary)	3.00	
Electrical News, printing account	96.90	
Express Order	.25	
Express charges	.60	
	$226.75	
Grant to Secretary	$125 00	
Secretary's travelling expenses to Ottawa attending Executive meetings	31.00	
Postage	35.61	
Exchange on cheques and drafts	13.38	
Express charges	.59	
Telephone messages and telegrams	2.85	
Stationery and printing	16.50	
		$451.68
		$333.18
Balance in bank May 31st, 1900	$339.83	
Balance on hand May 31st, 1900	11.20	
		$351.03
Unpaid accounts		17.85
		$333.18

RECEIPTS.

Money on hand June 1st, 1900	$11.20	
Money in bank June 1st, 1900	339.83	
25 Active Members' fees at $3.00	75.00	
4 Associate Members' fees at $2	8.00	
Envelopes used by Legislation Committee	1.00	
		$435.03

DISBURSEMENTS.

Convention buttons	$6.25	
Telegrams	1.83	
Postage	15.00	
Exchange on drafts	.90	
Ribbon for badges	1.11	
Stationery	.60	
Money on hand, August 27th, 1900	17.01	
Money in bank, August 27th, 1900	392.33	
		$435.03

The President : As the consideration of reports is put down for to-morrow morning, it may be laid on the table until then. According to custom, I will appoint Mr. A. B. Smith and Mr. B. F. Reesor to audit the Secretary-Treasurer's report. The next item is the reports of standing committees. We had a Committee on Statistics which was appointed two years ago, and continued last year. The Secretary will read you the report.

The Secretary read the report of the Committee on Statistics, as follows :

REPORT OF COMMITTEE ON STATISTICS.

MR. C. H. MORTIMER, Secretary C. E. A.

DEAR SIR,—I have your favor, also one from our respected President in referenee to my work as Chairman of the Statistical Committee of the C.E.A., and am very sorry to say that, while I have gathered a lot of interesting information and data, I have not been able to put it properly together or tabulate it in sueh shape that it will be of much value to the Association. I have been too busy to pay any attention to the matter beyond trying hard to do a little from time to time, and in that manner hoped to have had a fairly good report, but my trip to Winnipeg coming in within the last four weeks, completely destroyed any chance of my getting a report ready. I must ask the indulgence of the Association, and can only plead that the days are not long enough and not many enough to get through my business engagements, let alone any additional work. I must therefore ask that you kindly relieve me of the Chairmanship of this Committee and appoint somebody who will be able to give it more time and attention. I have considerable data whieh I would be glad to hand over to whomever you may designate. I trust you will have a very successful meeting and hope to be able to be with you one day at least.

Yours very truly,
(Signed) J. A. KAMMERER,
Chairman Statistical Committee.

The Secretary read the report of the Committee on Meter Inspection, as follows :

REPORT OF COMMITTEE ON METER INSPECTION.

To the Canadian Electrical Association :

GENTLEMEN,—Your Committee on Meter Inspection beg to report that they have since the last meeting of this Association interviewed the officers of the Electrical Inspection Branch of the Inland Revenue Department, with a view of ascertaining if the working of the Inspection Act could not be made easier to the electric light companies, and less expensive.

We have very much pleasure in reporting that we obtained a concession in the matter of inspection fees, viz : That whenever a meter requires inspection before the expiration of the five years covered by the last regular inspection, it shall be certified by the department for a fee of 50 cents only instead of the regular fee.

This, while it affects a saving to the companies, is also an evidence of the desire of the department to meet the electrical companies half way, and make the operation of the Act as little irksome as possible. I am,

Yours very truly,
A. A. DION, Chairman.

Mr. J. J. Wright read the report of the Committee on Legislation, which was as follows :

REPORT OF COMMITTEE ON LEGISLATION.

It was considered last year, at the time when the Conmee Act became law, that while there was not much danger of the fundamental principle of the bill being abrogated, that amendments would be brought forward from time to time which would, while intended to apply to special cases, interfere with the general working of the Act. These expectations were more than realized, for not only were amendents proposed in several ways, but a separate bill was introduced by Mr. Graham purporting to amend the Conmee Act in one or two particulars, but in reality repealing the Act and re-enacting an ingeniously worded measure that would have utterly destroyed the usefulness of the Act as originally passed by the Legislature of 1899.

It became necessary then for your Committee to take active measures to meet this threatened attack. In the meantime, in the expectation that some work would have to be done and expense incurred, a request was made to the various electric lighting companies interested for financial assistance, and a draft made upon the basis of the former subscriptions paid in. A sum amounting to about $400 was realized by this means, which was thought would be sufficient for the purpose, but the sweeping nature of the so-called amendments and the postponement of action, from time to time, by the parliamentary committee having the matter in hand, necessitated a much larger outlay. As the work of council retained by your Committee, as well as the efforts of individual members, held forth promise of ultimate success, it was deemed inadvisable for the sake of saving additional expenditure to jeopardise the success of work already accomplished. It was thought that the benefits accruing to the companies interested would be ample justification for this, and that in view of the important work accomplished we could reasonably look forward to increased assistance to enable all liabilities to be fully met.

The total disbursements on this account have been :

For legal services	$765.00
For telegrams, postage, stationary, printing, exchange, etc.	62.78
Making a total of	$827.78

To meet this there has been subscribed, during the year, the amount of $719.25, which, with $75.67 on hand from last year, makes a total of $794.92. This deducted from the total expenses leaves a deficit yet to be made up of $32.86.

While as a result of this effort the principles of the Conmee Act has become more firmly established than ever, it is altogether likely that further efforts will be made to amend or nullify it at future sessions of the legislature. Although this opposition will become less and less serious as time progresses, it will be necessary for this Association, as representing the industry of electric lighting and the distribution of power, to prepare to repel and neutralize these repeated attacks.

Your Committee has thought that some action should be taken to consolidate in a greater degree the interests involved, that special effort should be made to have every electric lighting company in the province identified with the Association. A number of companies who have benefitted to a marked degree by the work done by this Committee have not contributed in any way to the expenses incurred. If every company who are interested would assume a fair share of the burden, it would merely be a nominal one, and provision in a proper manner would be made to meet these periodical attacks upon their interests. Your Committee would recommend that the Association take some action looking to the consolidation of these interests and to a proper method of again making provision to meet attacks upon this legislation.

The number of companies and individuals who have subscribed towards the fund this year is 76; last year the number was 51. The names of the contributors are as follows :

Mattawa Electric Co.; Jos. Knox, Stayner : Paris Electric Co., Trenton Electric Co.; Parry Sound Electric Co.; North Bay Electric Co.; Tilsonburg Electric Co.; Rat Portage Electric Co.: Woodstock Electric Co.; Robertson, Rowland & Co., Walkerton; H. Gruetzner, Hanover ; Aylmer Electric Co.; Wingham Electric Co.; Bowmanville Electric Co.; W. Moore & Sons, Meaford ; Shelburne Electric Co.; Toronto Electric Light Co.; John Philip, Grand Valley ; Madill Bros., Lakefield ; Owen Sound Electric & Illuminating Co.; Napanee Electric Co.; Seaforth Electric Co.; Peterboro Electric Co.; Kingsville Electric Co.; Lindsay Light, Heat & Power Co.; Arnprior Electric Co.; Galt Gas Co.; Stratford Electric Co.; Stormont Electric Co., Cornwall ; Watford Electric Co.; Leamington Electric Co.; Pembroke Electric Co.; St. Catharines Electric Co.; William Snider, Waterloo ; People's Electric Co., Windsor ; St. Thomas Electric Co.; Gananoque Electric Co.; Welland Electric Co.; Port Hope Electric Co.; Sarnia Electric Co.; Smith's Falls Electric Co.; Uxbridge Electric Co.; Ottawa Electric Co.; L. H. Reesor, St. Marys ; Strathroy Electric Co.; W. A. Mackay, Renfrew ; A. A. Wright, Renfrew ; Cataract Power Co., Hamilton ; Howes & Leighton, Harriston, Ont.; Simcoe Gas & Water Co.; Cobourg Electric Co.; Norwood Electric Co.; Carleton Place Electric Co.; Brantford Electric & Operating Co.; Alliston Electric Co.; London Electric Co.; Kingston Electric Co.; Gravenhurst Electric Co.; Hamilton & Prout, Forest ; Dunnville Electric Co.; Guelph Electric Co.; Midland Electric Co.; Berlin Gas Co.; Markdale Electric Co.; Almonte Electric Co.; Georgetown Electric Co.; Ingersoll Electric Co.; Dundas Electric Co.; D. A. McIntyre, Paisley ; R. P. Bearman, Chesley ; Clinton Electric Co.; Kilmer, Crawford & McIntyre, Durham ; Petrolea Electric Co.; I. J. Gould, Uxbridge; Wallaceburg Electric Co.; Wiarton Electric Co.

Your committee is glad to be able to state that the legislation obtained and protected through its efforts has been of the most vital importance to several companies during the year, in preventing what might be termed the absolute confiscation or destruction of their property. At the same time, the measure is eminently fair to the municipalities and protects their interests equally with those of the companies concerned.

Your committee have to express their acknowledgement to those gentlemen who actively assisted them, at considerable sacrifice of time and at their own expense, in defending the rights of the companies before the Legislature.

J. J. WRIGHT,
Chairman Committee on Legislation.

The President : There was a Committee appointed to confer with the Underwriters, a continuation of the Committee of the preceding year ; Mr. Gossler is the chairman of that Committee.

Mr. P. G. Gossler : Your Committee appointed at the last convention, consisting of Mr. Sangster, Mr. Dion, Alderman Sadler and myself, met on the 15th January last in the Windsor Hotel, Montreal, with a view of discussing and considering a by-law which it is proposed to incorporate in the building by-laws of Montreal, known as the Montreal Building By-law of 1899. Section 168 of this by-law proposed that all electric installations within the city of Montreal should be inspected and a certificate of inspection, to the effect that the installation is in accordance with the Board of Fire Underwriters' rules, should be issued before such connection was made. Alderman Sadler had taken up this proposed by-law in detail, and after due consideration of the matter, especially in view of there being nothing definite stated in the proposed by-law as to who should stand the expense of this inspection department, it was not thought advisable for your committee to take the matter up in a formal manner. However, as the Secretary of the Board of Fire Underwriters, Mr. Hadrill, expressed last year that he was in hopes that municipalities would pass such by-laws throughout the Dominion that would make the enforcement of the Fire Underwriters' rules part of the building laws, and that the expense of such enforcement or compliance with the law would be stood by the municipalities ; it would seem that this by-law was intended to be the first step in that direction, and, after considering the matter at the Windsor Hotel, as I stated before, it was not thought advisable to take the matter up until such time as this by-law was presented for enactment before the city of Montreal. The Committee really has taken no definite steps except to familiarize itself with the proposed legislation, and having Alderman Sadler keep his eye on the by-law as it progresses. There has really been no progress made towards having a definite bureau of inspection established in the Province of Quebec or throughout the Dominion, and at the suggestion of the meeting it was resolved to let the established systems of inspection as then existing remain without being interfered with. I further wish to say that the minutes of that meeting to discuss that by-law in detail, and also a copy of the proposed by-law, will be incorporated in my report to the Association.

The President : There was a committee appointed last year at Hamilton to deal with the proposed "Standardization of Accounts," as suggested in a paper read before that convention. We have a report from Mr. D. R. Street.

The Secretary read the report, as follows :

REPORT OF COMMITTEE ON STANDARDIZATION OF ACCOUNTS.

To the President of the Canadian Electrical Association:

Sir,—As there is apparently an idea on the part of the executive of the Association that I am chairman of the committee "to formulate a standard system of accounting for our central stations in Canada," I take the liberty of reporting that at a meeting of this committee held in the Royal Hotel, Hamilton, on the 30th of June, 1899, at which Mr. Hatr, Mr. Wright and myself were present, Mr. Hart was unanimously chosen as chairman of the committee, this being out of deference to him as the author of a very excellent paper on accounting read at the last convention, from which the present committee is the issue.

As Mr. Hart, the chairman, I understand, is in the Lower Provinces, and may possibly not be at this convention, and as it is impossible for me to be there on the first day, I take the liberty of stating that the committee has done some work, though not much. However, a start has been made and a certain amount of correspondence has been done and data collected, forms have been received from Mr. T. E. Oakley, of Fort William ; we have Mr. Hart's paper read at last convention, also a communication from the Librarian of McGill College saying that a copy of the report of the National Electric Light Association proceedings held in Montreal some eight years ago, and which contains an excellent paper on accounting, is at the disposal of the committee at the College, but unfortunately cannot be removed. We also had a very good paper upon the same lines that this committee is working, from Mr. Colquhon, submitted at the last meeting of the National Electric Light Association.

Please bear in mind that should Mr. Hart be present, as he possibly may, he will, of course, have his own report as chairman, and I would respectfully request that this letter to yourself should in that case not be used.

Yours truly,
D. R. STREET.

The President : There was a proposal to establish a standard for arc lamps which could be embodied in contracts to take the place of the old standard of 2,000 or 1,200 c.p., which led to many disputes ; it was taken up at the last meeting and discussed to some extent and a Committee appointed to make some suggestion at the next convention. Mr. Higman, of Ottawa, was chairman, and Mr. Gossler was a member of that Committee. As Mr. Higman is not here and has sent no report, perhaps Mr. Gossler could make a verbal report of what has been done by that Committee during the year.

Mr. P. G. Gossler : Mr. President, after consideration of the matter and the remarks that were made at the last convention, it was thought that it would be premature to decide on any definite standard at the present time for illumination of arc lamps. There are so many possibilities of inaccuracies being introduced in the rating of street lights on a basis of c.p. that such a rating has almost been entirely superseded by the watt basis, that is, the watts consumed per lamp, and at the present time the same energy in different types of lamp gives a very decided difference of illumination; it was thought best to not even make any suggestions towards a definite standard until such time as there was more universal accord on the subject of exactly what energy should be used in lamps, or what illumination could be expected from different classes of lamps. As you all know, there is a very great diversity of opinion on the subject.

Mr. J. Yule : Wasn't there a resolution carried ?

Mr. Gossler : Not being chairman of the Committee, I am really not familiar with the details. There may have been a resolution. You were present, were you not, Mr. Yule ?

Mr. Yule : Yes.

Mr. Gossler : You were a member of that Committee.

Mr. Yule : My recollection is there was a resolution.

The President : My recollection is we passed a resolution in order to narrow down the discussion, which had been of a very rambling character. A resolution was passed to bring the discussion within a certain channel, but that resolution was to the effect that the rating should be on a wattage basis, and there were some other things besides that which were to serve as a basis for discussion at a future meeting, but that other meeting not having been held, I don't know that it would be wise to present the conclusions of that first meeting as a report. It was only preliminary, and it may have been all undone at a subsequent meeting. I agree with Mr. Gossler that it would not be safe to express ourselves on this point which is now engaging the attention of more important bodies elsewhere; we might let them speak first. Possibly to-morrow, when the consideration of these reports comes up, we might decide to continue the committee and see what they can do next year.

Mr. Gossler: In connection with Mr. Yule's suggestion of a resolution having been passed relating to the wattage to be used per lamp, I may say that there may be the same wattage in the arc and yet have altogether a different illumination. Of course, it depends upon the character and size of the arc.

Mr. Yule: You were asked to report on that.

Mr. Gossler: If I was I certainly have overlooked it. I have not gone into it with a view of making a report. I could possibly talk for an hour and a half on the subject of arc lamps, but I didn't know I was to make a report.

Mr. Yule: I mean to a subsequent meeting of the Committee, not to this convention. It is understood this Committee has no power whatever; they simply make a recommendation to the government department.

The President: The next order is the appointing of the Nominating Committee. The duties of this Committee are to suggest names for the various standing committees for the coming year and for the officers to be elected on the 31st. I will appoint on this committee Messrs. E.E. Cary, P.G. Gossler, J.J. Wright, J. Yule and J.F.H. Wyse. If these gentlemen will get together between this and to-morrow, they can take as a basis for the committees last year's list; the same committees will very likely be continued, and suggest who should compose them, as well as the officers for next year. This is intended as a guide and a help to the convention. It is not binding by any means, and other nominations can be made when the time comes.

The President: I think if there is any general business to be brought before the convention, we should hear it now, because the author of the first paper on the list is not here yet, and the time at our disposal this morning is short.

Mr. J. J. Wright: On the other hand, there are others who have some business to bring before the convention, thinking it will come after the reading of the papers.

The President: I would like to have a little larger audience for the reading of the papers, and I think we will have it this afternoon.

Mr. J.J. Wright: I would suggest that an adjournment would be in order now until the afternoon session.

The President: I am sorry to see such an old member as Mr. Wright talk about wasting time in this way. However, if that is your wish, all right.

Mr. Wright: If there is any business to come before the convention which members wish to bring up now, I am quite agreeable.

Mr. J.F.H. Wyse: I understand there is a motion to adjourn. I second the motion.

Mr. Gossler:—As a further suggestion, I know that on the next train from Montreal there will be at least ten or fifteen members, and it will be hardly fair to them to proceed. However, it may not be fair to us for them to stay behind. But a postponement for an hour or two hours will probably not be out of the way.

The President: It is moved by Mr. J. J. Wright, seconded by Mr. J. F. H. Wyse, that this meeting adjourn until 2.15 this afternoon.

On a vote having been taken, the motion was declared carried.

AFTERNOON SESSION.

At 2.45 p.m. the President called the convention to order.

The President: The first order is general business; if there is nothing in the way of general business, we will pass on to the reading of papers. The first paper is by Mr. Camp, C.P.R. Telegraph Company, Montreal. I have a telegram from Mr. Camp stating that he will arrive at 4.30 this afternoon, and asking us to postpone the reading of his paper. The next is a paper by Prof. Owens. I have a letter here stating that Prof. Owens has been called away to Maryland on account of the death of his sister. Prof. Owens did not send in his paper. The next is a paper by Mr. F. H. Leonard, of Montreal. Mr. Leonard is in the city, but is not here just now, and as it is getting late, Prof. Herdt has consented to read his paper now. The paper is on "Conditions Affecting the Wave Form of Alternators."

Prof. L.A. Herdt, McGill University, Montreal, read his paper. (See page 171).

The President: You have heard the able paper by Prof. Herdt. As he has stated, the subject is of great importance, especially now when alternating current generators are being used to such an extent that all services, not only incandescent lighting, but arc lighting and motors, are furnished from alternating current generators. To those of us who have been accustomed to look upon the sine curve as approximately correct in dealing with alternating current phenomena, the results shown here are somewhat startling. This paper is open for discussion, gentlemen. I regret the fact that the papers could not have been placed in the hands of the members some time before the opening of the convention, because papers of that nature require some study. It was our purpose that there should be opportunity for studying them. I must say, however, that although the Committee on Papers have used their utmost endeavors to get the papers printed in time, they have failed. Could we hear from Mr. Leonard on this subject?

Mr. Leonard: Well, no, I am hardly prepared to say anything on Prof. Herdt's paper. I didn't come into the room until the paper was half through, and I would like to study it a little further before taking up any discussion on it.

The President: Perhaps we had better postpone the discussion on this paper until to-morrow. Are there any gentlemen here who would like to discuss this paper?

Mr. Gossler: I would like to ask Prof. Herdt a question for the purpose of getting information. Not having read the paper, I am not very familiar with its contents. Plate 3 shows different curves of electromotive force and different power factors there, and I notice that the maximum electro-motive force of each curve comes within possible 15 degrees of either side of the 90 degree line. You have shown here electrical degrees from zero to 180, and the maximum electro-motive force on all these curves is within 15 degrees either way of 90 degrees. You have your maximum electro-motive force practically on a straight line.

Prof. Herdt: Yes.

Mr. Gossler: I was under the impression that frequently the demagnetizing effect distorted the magnetic field so as to throw the maximum E.M.F. further than 15 degrees one way or the other.

Prof. Herdt:—The ordinates of the curves at load have been plotted 60 volts below that of the preceding ones, for clearness. At full load, 100 per cent. power factor, the electro-motive force is shown to be shifted about ten degrees in the direction of rotation; however, as the power factor is decreased, this is gradually reduced until we find that with a power factor of 55 per cent., the electro-motive force wave is nearly back in the original position of the no load wave.

Mr. Gossler:—It is an individual characteristic of the machine. I should say that was a very good machine.

Prof. Herdt:—It is a very good machine. If you like to consider that later, Mr. Gossler, we can do so.

Mr. Gossler:—I just wanted to get that information.

The President:—Is there any further discussion? If not, we will go on with Mr. Leonard's paper, and we will give you an opportunity to take Prof. Herdt's paper up again to-morrow. I have much pleasure in calling upon Mr. F. H. Leonard, of Montreal, to read his paper entitled "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps."

Mr. F. H. Leonard read his paper. (See page 173).

The President : Gentlemen, I think I may state that this is one of the best papers we have had submitted to this Association. It deals with matters that as central station managers some of us have to consider very seriously, and I wish you would give it a very full discussion. It contains a great deal of interesting matter, from the standpoint of theory as well as that of practice, and I hope it will receive due consideration. It is now open for discussion.

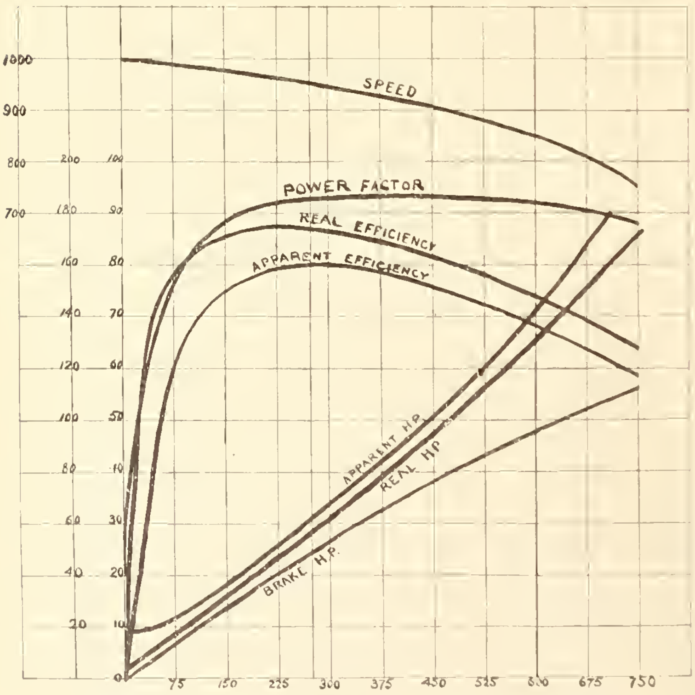
Mr. E. E. Cary : Mr. President, don't you think it is somewhat necessary to allow the members to digest these papers over night. There are a number of modest individuals here, and their digestion is a little out of order, and it is only in the morning they are prepared to tear the papers to pieces. I would offer the suggestion that we read another paper and then discuss the three of them in the morning.

The President : I am quite agreeable to that, but if there are any members here who have anything to say on the papers now, or wish to ask for iofor mation, I think we might hear them.

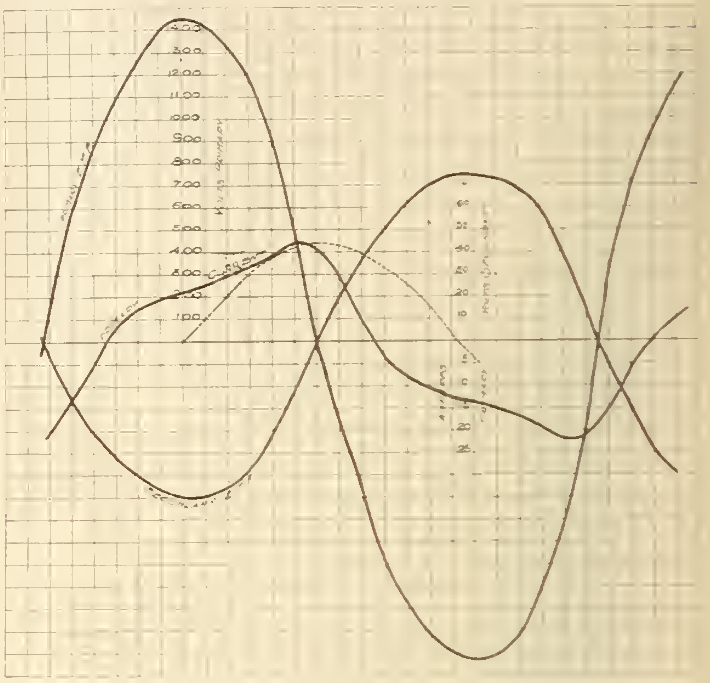
Prof. Herdt : I would like to say a word in regard to one paragraph here at the top of page 5: "If this leading phase displacement can be made equal to the lagging phase displacement of other devices, a power factor of unity would result, as suggested by an eminent engineer, though in practice, during a period covering the whole history of this branch of the art, I have never met such a condition, nor have any of my friends in the profession, many of whom have had extensive experience with synchronous and induction motors separately and both together on the same circuit." In regard to that point, is it not so that the difficulty in obtaining unity power factor is due to the difference existing between the wave form of the generating and receiving machinery? Still in most cases it seems that with a proper adjustment of field excitation the power factor may be made to reach very close to unity.

Mr. Leonard : On that subject I can state at the end of an experience extending over several years in manutacture and experiments leading up to the manufacture of a single phase, self starting synchronous motor, I have concluded, as I intimated in the paper, that over-excitation cannot be carried too far. If a synchronous motor is over-excited beyond a certain limit, it begins to make the circuit unstable and there immediately results a very vigorous pumping and flickering of the lights which makes the thing utterly impracticable on a commercial circuit. Theoretically it may be otherwise, but in practice there are mechanical and electrical difficulties which enter into the question that, so far as I have been able to learn, put the thing out of the question entirely. I would like very much to meet somebody that has ever had the experience of obtaining the power factor of unity on motor work. I have talked on the subject frequently with many of my friends who are quite prominent in the profession, and who have had excellent opportunities to investigate this matter, but up to now I fail to find anybody who has secured this wonderful, or what seems to me wonderful, result. It is theoretically all right and should be obtained, but in practice it seems to be out of the question.

Mr. Gossler : In regard to the matter of unity power factor, does not Mr. Leonard mean to say that the power factor of unity is rather an unstable quantity under commercial conditions, and not that it cannot be procured, for I know unity power factor can be obtained, but there has been difficulty experienced in maintaining unity power factor under commercial conditions. It is a well known theoretical fact that unity power factor can be obtained, but there has been experienced considerable difficulty in maintaining unity power factor on account of the unstable conditions existing at the time. I have not had an opportunity of reading this paper before it was presented, and as it is going to be discussed to-morrow, I desire to bring up a few points for information, and which I should like to hear discussed in the morning. I notice that after a discussion of the characteristics of the synchronous and induction motors, that the statement is made that the preference is altogether in favor of a well designed induction motor. Now, while the usefulness of the induction motor is without question, there are also certain conditions which make the synchronous motor almost indispensable to a large operating system. When under the control of the central station the synchronous motor is one of the most valuable adjuncts to a general supply system. This is well illustrated under practical conditions in the Buffalo arc light system, where the power factor on the general system is maintained, I understand, under their conditions at about .97 or .98. I do not think there is any claim that induction motors operate at a power factor of .97 or .98, or that they can be made to better the power factor system so as to maintain it under normal conditions anywhere in the neighborhood of .97 or .98. It therefore seems that the impression which I have obtained from Mr. Leonard's paper that the preference is to be altogether in favor of a well designed induction motor over the synchronous motor, is wrong. I know of several large installations that are at present being designed where it is proposed to install synchronous motors. In another part of Mr. Leonard's paper he has compared the action of the induction motor to a transformer, stating that, being complete in itself, the regulation was automatic. The impression which I have gained from this statement is that there is no regulation of the generator required to overcome increases or decreases of the load on induction motors. The operation of induction motors shows that regulation of the generators is necessary to compensate for changes in load on the motors. We know that throwing a load on an empty transformer increases the power factor of the general system, and consequently permits of better regulation, for the reason that it brings the current more nearly in phase with the electro-motive force, but certainly regulation of the generator is required to compensate for any increase of load on the transformer, even if the load introduced does bring the current more nearly in phase with the electro-motive force ; consequently the impression given in this paper that an induction motor causes an automatic regulation of the system, and no change of field excitation is required, is incorrect. Mr. Leonard further states that the best load for a synchronous motor is one of a steady character. This same statement applies to induction motors, engines, water wheels, or any motor. Mr. Leonard has stated that as high a power factor of an induction motor under full load conditions has been obtained as .94, but there are very few conditions, especially when there are a great many of them, which allow of motors being operated continuously at full load. There has been reference made to an operating plant where in one installation there are about 3,000 h. p. in motors, ranging from fan motors to motors of 500 h.p., and that recent measurements showed the power factor of the circuits supplying this installation to be about .90. I think I know what plant Mr. Leonard has reference to, because I operate it. I may say we found that under certain conditions we had on our transmission lines supplying our entire system at our power house a power factor on a commercial load of about .94 ; the load consisting of a general lighting and power business ; several large motors being of the synchronous type ; we found that by removing about 25 per cent. of the synchronous motor capacity, and placing additional induction motors on the system, the power factor was reduced from .94 to .87, thereby reducing the full load unity power factor capacity of the generator from about 88 to 75 per cent. In stating that it is necessary to have synchronous motors started by means of external starting apparatus I presume the self-starting synchronous motors have been overlooked. However, the latter absorb a large amount of starting current, frequently several times the full load current. I also know of a number of induction motors in commercial use that require several times the full load current for starting. I think the Association is certainly very much indebted to Mr. Leonard for that paper, because it is on a subject that is pretty close to us all. I think we all regret that we have not had a chance to make a pretty close study of it before it was presented. There is one more note I have marked in reading it over. Mr. Leonard, I see further on, recognizes there is some use for synchronous motors. He says: "In some notable cases where central stations are using power transmitted from a distance, induction or synchronous motors have been coupled direct to D.C. arc dynamos; this would be the ideal place to use a synchronous motor immediately under control of the central station if the induction motor load occurred at the same time, but unfortunately they occur at different periods." The maximum demand on a central station supplying light and power is at the time when the lighting of offices and stores and the day power business overlaps the evening lighting load. In Montreal this overlapping of day load and evening load occurs during seven months out of the year, also, at the same time the arc lights are operating, so that the power required to operate them is in demand at the time of this overlapping; consequently any synchronous motors used to operate arc machines could, during seven months of the year, be used to better the power factor on the general system, in consequence of which there would be available more generator capacity than if the arc lights were operated by means of motors having a lower power factor than that obtainable with synchronous motors.

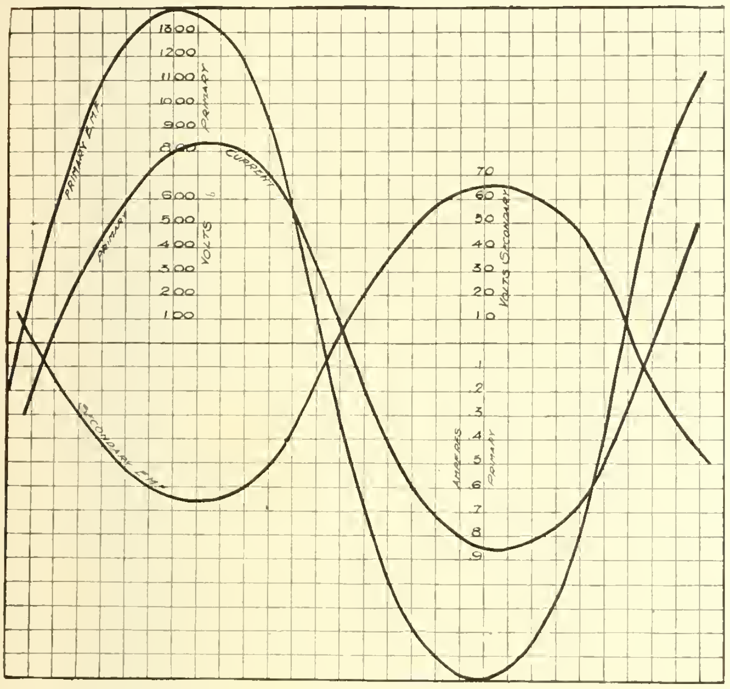


Performance Curves—50 h. p. Induction Motor.



Transformer Curves—Open Secondary.

Mr. Leonard: I don't think I differ so very much from Mr. Gossler on a good many of the points. I called attention particularly in my paper to the fact that there are places in which a synchronous motor can be used to great advantage in overcoming line drop. If you could distribute synchronous motors at certain centres of distribution where your drop is heaviest and your variation in load the greatest, and you have an attendant there in charge who is under control of the central station, as I say in the paper, it would certainly serve as a very valuable adjunct to the central station management. You would reduce the amount of copper and you would require less attention at your switchboard, although that would have to be made up by the attention of the man at the motor, while under those conditions it would be necesssary to have the synchronous motor large enough in capacity so as to take care of the work it has to do as a motor, and besides that have capacity for furnishing leading currents to overcome the lagging currents produced by other inductive devices. With regard to power factor, Mr. Gossler in his remarks made a little slip; he said that the induction motors made the power factor higher. I think he meant the reverse. The case that Mr. Gossler mentions was one where we took the two synchronous motors (we only had two on) off our line, and in place we put in all of the small induction motors, many of which were running under load. A small induction motor does not give as good a power factor usually as a large one; they improve slightly as the size increases, but a small induction motor with a light load, it is recognized, has a lower power factor; and as I say in my paper, the regulation of the line may be improved by the use of the induction motor. I think that experience will bear that out. We have at full load a very high power factor. I have a diagram here which I have taken and I will put it up. This is the line we have been considering; that is the power factor. This, I may, say is taken in actual practice from a modarate sized induction motor; it has a capacity of 50 h.p. This is the full load line here. Now, you see the power factor starts at about 20. The observations are not very accurate on these starting loads; here we start with a power factor of about 20 at practically no load. It almost instantly reaches 40, and then up to 60, and then rises gradually as the load increases, this line crossing under here and going over this point up to 93, almost 94, with even that small-sized motor, where the generator conditions and so forth are right. What I was trying to maintain was that the regulation of the line is assisted—not altogether compensated for, I might say—but assisted by the use of induction motors rather than synchronous motors. At full load we have a power factor of .03, and we will say at 25 per cent. overload we have got very nearly .04; all over this range the power factor is very nearly uniform. I call attention in the paper to the fact that the induction motor should be selected particularly with regard to the amount of work it has to do, so as to obtain the best conditions of power factor. That is, if you have a load of 10 h.p. for five minutes out of the day, and 7 h.p. for the other nine hours and 55 minutes, you should buy, not a 10 h.p. motor to take care of that 5 minutes, but a 7 or 7½ h.p. motor so as to obtain the best conditions. You can stand an overload of 25 per cent.; your power factor is really improved by that load; all over this range your motor is running at good power factor; if there is any slight increase or overload the motor is safe if it is properly designed, as it should be designed under those conditions. If you throw a load off from an induction motor you immediately reduce the power factor. Mr. Gossler said the power factor will vary the electro-motive force something like the square of the variation in the power factor. Under those conditions you have thrown off your load, your generator has lost part of its load; the natural tendency of any generator with fixed excitation would be to increase its electro-motive force ; it would immediately, if you throw off a certain amount of load, build up and increase the electro-motive force. With an induction motor having its load thrown off, it brings the power factor down into this part of the curve (refers to diagram), and in doing so it demagnetizes the field of your current generator and prevents the increase of the field and lowers the electro-motive force slightly and compensates, in a measure, for the change of load. I don't mean to maintain that that will compensate automatically for every change. You cannot do away with your switch-board attendant entirely, but I merely wish to call attention to the fact that it assists in the regulation ; whereas in a synchronous motor, if a load is thrown suddenly off, your voltage immediately rises. You have introduced leading currents, you increase your field strength by the armature reaction, it raises the electro-motive force immediately and will cause trouble with incandescent lights if your attendant is not very sharp with his work. If there are are any other points I would be very glad to take them up to-morrow morning. I will give a chance for somebody else to say a word now.



Transformer Curves—Full Load.

The President : Are there any other members who wish to speak on this ? There is a point mentioned by Mr. Leonard at the top of page 5 where he states that a leading current may be produced in a synchronous motor to compensate for the lagging current due to other devices. He says, it has been stated by an eminent engineer, and it has been stated by a number of authorities, and it is a question which central station managers who are operating alternating current motors want to know all about. I may say it has been stated to me by eminent engineers of manufacturing companies, that while this was theoretically so, it was, as stated by Mr. Leonard, almost impossible to realize in practice. Now, this is the point we want to know about. It has been held by people who are interested in having synchronous motors used that this is a valuable feature of the synchronous motor, that you can use it to off-set the lagging currents due to other motors or other devices on your circuits. Others state that it is impossible to obtain these results in practice, except under conditions which have to be so nice that you do not get them as a general rule, and if anybody can give us more light on this particular point to-morrow we will be very glad to have it. If there is no further discussion to-day we will allow the paper to lie on the table for further discussion to-morrow, and we will pass on to the paper on " Some Experiments with Rotary Convertors," by Messrs. A. G. Grier and J. C. Hyde.

Mr. Grierread the paper. (See page 175).

The President : The auditors whom I appointed this morning have completed their work of auditing the accounts of the Secretary-Treasurer and have certified them to be correct in every particular. If there is any general business to bring before the meeting this would be a good opportunity, a better chance now than to-morrow. If there is nothing I would ask someone to move an adjournment.

Mr. J. J. Wright moved, seconded by Mr. P. G. Gossler, that this meeting adjourn until to-morrow morning at 10 o'clock. Carried.

SECOND DAY.

At 10.30 a.m. the President called the convention to order and said : The first item is the consideration of the President's address. The reason for this order of the day is that there are some suggestions in the President's address which may be taken up by the Association. As you know, there are still a number of electric companies in Canada that are not represented in this Association, and it has always been the aim of the Executive Committee to bring these in, if possible. I will read you the suggestion which is made in the address in connection with that : " It is a source of gratification to me that our membership continues to increase notwithstanding that a considerable number of members drop out of the Association every year. We should put forth our best efforts to prevent, if possible, these annual lapses, and we should not rest satisfied until every electrical operating, manufacturing and supply company, firm or individual is represented on the membership roll. In this connection I would submit for your earnest consideration whether it would not be well to introduce in our constitution a feature of company membership such as carried out by the National Electric Light Association of the U.S. in addiion to the individual memberships, which could remain open to those who wished to avail themselves of them." I thought it would be well to get an expression of opinion from the convention as to that feature. Can we hear from Mr. J. J. Wright on that subject? It is a matter we may not be able to dispose of now, but it would be well to talk it over. You know that the National Electric Light Association is composed of companies ; the companies pay $25 a year and send their representatives. It was thought that where the companies do not send the same members every year, that company membership would be, perhaps, a means of getting the companies interested.

Mr. J. J. Wright :—As I understand it, there are a number of companies represented in our association already.

The President : As companies ?

Mr. Wright : As companies, I think.

The President : No. Their officers are members individually. We have no such thing as company membership.

Mr. Wright :—That would be an amendment of the constitution, and would require notice for one session. I am willing to introduce a resolution to that effect, giving notice of an amendment of that kind, and leave it to be discussed at the next convention. We cannot take any action on that except to propose it.

The President : I thought if we could get an expression of opinion from the convention, the executive committee for the coming year would know what to do.

Mr. Wright : That would blend itself with another matter which will probably come up later, and that is with regard to identifying the electric companies with the Association in the matter of looking after legislation and so forth. If the electric light companies are to become interested in the Association as companies, of course the Association would be in a very much stronger position to take hold of matters connected with legislation ; and the present haphazard method of making provision for legislation by raising subscriptions and so forth would be very much simplified. We have no means now except by making a draft on the various companies as occasions arise ; we have done that already three times practically, and it is a question, of course, how far it is proper for that method to continue, and that is a matter which I think will have to be taken up by the legislative committee and executive committee, probably jointly, during the coming year, to see whether an organization of that kind could not be completed. Your suggestion, perhaps, that the companies should become interested, might be right in line with that idea.

Mr. H. R. Leyden : It seems to me that is exactly the line in which this association has been developing for the last couple of years. This association is not what you would call an association of electrical engineers ; its principal object and its principal work has been the benefit of the companies. The men who come here to this association are usually sent here by the companies and their expenses paid by the companies. As Mr. Wright says, one of the principal objects of the thing is for the enacting of such legislation as will protect the companies, and it is the companies that have been paying for the expense of such legislation, and it seems to me we have been gradually working away from the idea of an electrical engineers' society and becoming an association for the benefit of electrical interests ; and it seems from that point of view it should be the companies who are represented and not the individuals.

The President : There is this difference between our society and the American association, that while a company sends a representative here and pays his expenses, if that company wishes to send another representative next year he has to get a membership, while if the company held the membership and paid a higher fee than the individual subscription, that company would be free to send any representative or any number of representatives. Of course, when it comes to voting, the voting will have to be limited, but any number of representatives might be present at the convention from one company.

Mr. Gossler : I don't like to see the idea encouraged suggested by Mr. Leyden that we are working away from an engineering body ; the matter of legislation and commercial operation of our plants can be managed by purely business men and business associations ; I would very much rather encourage this as being more of an engineering society for the advancement of engineering and commercial operation. I think your suggestion of having the company membership is a very excellent one, as it will bring the association to address the companies rather than their individual representatives ; that is, the association has had its support from the companies, and it has gotten that support from individual efforts rather than making a direct appeal to the companies. I think the suggestion as put forth by the President should be put in formal shape, perhaps by resolution put before the association, which will allow it to become a part of the constitution of the association.

Mr. E. E. Cary : I think Mr. Gossler's suggestion is a very good idea, but one point that appeals to me is this, I think both the commercial interests and the scientific interests can work harmoniously. Our meetings in the hall, the same as in our neighboring Association on the other side, would generally be devoted to the scientific side of our work ; naturally, the other side gives more or less entertainment when we are not in the hall for discussion. The papers will be more scientific than commercial, of necessity. In addition to this I would like to say a few words regarding the matter of exhibits. This is the first year that any of us have been privileged to exhibit under the auspices of the Association. There is a peculiar meaning in that to me. The manufacturer or jobber gets the agency from any foreign country of any special apparatus which have been developed and brought out during the year, it may have been described in the journals, but very few of the central station managers, perhaps, have been privileged to see the latest developments—the large exhibits such as the Electric Light Association have on the other side bring together all the latest developments of the year ; it is not to sell, at the time ; in fact, the manufacturer or jobber who respects himself would severely reprimand any representative who tried to really do business, but it is to our interests to have the criticism of central station managers upon anything we bring out, because no matter how carefully we may test any apparatus, I never saw a piece of apparatus placed on the market that central station managers could not tear to pieces and improve. They have conditions which we cannot always duplicate in our testing rooms, notwithstanding our best efforts to do so ; consequently, we get their suggestions, and they see the results of our efforts. You may say, that is purely for commercial reasons. We are all after the money, there is no doubt about that, but unless you have the best and most economical apparatus you cannot make as much money during the year following the convention as if you had it. And I think any manufacturer, if he appreciated that element the way it is appreciated in the old country and in the United States, would make an effort to show anything of recent development, and the means he has devised to help you in your operating expenses. I think both sides, the strictly scientific and the commercial elements, will not conflict, but will harmonize, because our papers will be scientific, and between our sessions we can view the exhibits, and the more working exhibits we have I think the better everyone will be pleased. I feel very strongly on this matter, for I was interested for some twelve years on the other side, but as you all know we have not been privileged to do anything here before. The time has been extremely short this year. We are not as busy as our competitors, so we had more time to devote to it. But another year, if it is thoroughly understood, you will find all the manufacturers here exhibiting. I had to work nights, gentlemen ; I worked overtime. We have not much upstairs, but we manufacture bunting and ice cream and so forth at St. Catharines, and that is what we are showing. Another year we will show you some apparatus. (Applause).

Mr. Yule : Of course, I represent purely the commercial side of the electric light business. As it is, there is a good deal in what Mr. Wright says, that company membership would interfere somewhat with another proposition we have to bring forward. There is one thing about company membership in getting a fee sufficient to meet our expenses, and that is, you cannot get the same amount of fees from a small company that you can from a larger company. Some of them are not able to pay a very large fee, and some of them are able and willing to pay it. The conditions on the other side are very much different from what they are here, and we have to modify our plans. This question will come up again, I understand, in the legislation report. I would move that the recommendation of the President be sent on to the Executive Committee for consideration.

Mr. Cary : Couldn't that be on a sliding scale according to capitalization—so much for each thousand capitalization, then nobody would feel injured at paying too much.

Mr. B.F. Reesor: Doesn't that mean that a company could have a company membership or not, just as they pleased ?

The President : Yes, that was my idea ; it would be optional.

Mr. Reesor : The small company would send the same man every year ; the large company would pay a $25 fee and send two or three men, and change around occasionally.

Mr. H. O. Edwards : There would be a larger fee entitling them to a larger number of delegates ; the larger company would want to send more delegates than the smaller company ; the smaller company might have a smaller fee, entitling them to one, two or three delegates, and the larger company more.

Mr. Reesor : How would that be when it comes to voting ? The large company have three or four votes and the small company one?

The President : I think in the National Association each company has one vote.

Mr. Cary : They are privileged to send any number of representatives, but only one official representative.

Mr. Leyden : It seems to me we are confusing two things, the fee that the company would pay for membership, and the amount that a company should contribute towards the expense of the Association. I don't see that you can charge one company more than another for membership fee in any association. We should, it seems to me, have a fee which is reasonable and charge all the companies the same fee, and when we want to take up a collection to raise money for legislative purposes it will have to be done outside of that, and the larger companies necessarily will be expected to pay more than the smaller companies. I don't see how you could have a sliding scale for membership fees.

Mr. C. Doutre: There are companies who, at the present day, have two or three delegates whom, I presume, are individual members. It is going to be pretty hard to decide upon any equitable fee for company representation. There are companies who invariably send three or four delegates, and other companies will only send one, and those companies who send one will object to paying any company fee which would be considered equitable, because you could not put the fee down at any $3 or $5 basis; they would overcome that by sending simply individual members. I think there is nothing to be gained by introducing a company membership fee, because those companies who object would simply send individual members, and those companies who have five or six parties they wished to send would pay the fee, which would be a nominal one, and the Association would lose by it.

Mr. Cary: I think there is one point Mr. Doutre has omitted. No company would be privileged to exhibit at the convention unless they were members of the Association as a company. If we bring that up to the proper level, any company that has any respect for itself at all will pay $25 for the privilege of exhibiting.

Mr. Gossler: As I understand your suggestion, the matter of company membership is simply to augment the membership of this Association; it would in no wise eliminate individual membership.

The President: It is suggested as a possible means of reaching and interesting companies who now have no individual membership. It is moved by Mr. Yule that this matter be referred to the Executive Committee.

Mr. A. B. Smith: I second that.

The President: The Executive Committee would report to the next convention. It might be in the form of an amendment to the constitution.

Mr. Reesor: That would put it off for two years. You could put it in as a notice of motion.

The President: If we are agreed as to what we want we can put it in as a notice of motion, but I hardly think we have reached that point to know exactly what we want.

Mr. Gossler: There must be some means of putting that before the Association so that it will not take two years to act.

The President: I think we could put a notice of motion in general terms and we could arrange the details to suit ourselves.

Mr. Reesor: Put it in as a notice of motion and the Executive Committee in the meantime can deliberate and report at the next meeting.

The President: Article 10 of the constitution says: "Permission to introduce any notice of amendment or amendments to this constitution must be granted by a majority of two-thirds of the active members present. Permission being granted, notice may be given and the proposed amendment moved at any subsequent sitting. After discussion the amendment must be submitted to a committee of five, named by the chairman." There is only one motion before the chair, that by Mr. Yule, seconded by Mr. Smith, that this matter be referred to the Executive Committee.

Mr. Cary: Would Mr. Yule be willing to withdraw that and make the motion that the chair should appoint a committee. We are a little hazy, I think, on the constitution. What is your wish in the matter?

Mr. Yule: I don't understand what you want.

Mr. Cary: To follow the constitution. The president says if he appoints a committee of five they can report to-morrow; that won't postpone it for even a year.

Mr. Yule: I will withdraw my motion.

Mr. Reesor: The way I understand it you will have to take a two-thirds vote of the meeting to allow the constitution to be amended.

The President: Yes, there must be a two-thirds vote of the members present to grant permission to introduce the amendment. When the amendment is introduced I refer it to a committee of five.

Mr. Yule: I will take the original motion, that it be referred to the Executive Committee, and that they be asked to report at the next convention.

Mr. Wright: I would vote against any amendment to the constitution at this session; it would not be advisable.

The President: I don't think myself it would be well to be too hasty about this, and probably if we could amend the constitution at the next convention it would be quite early enough. Will your motion stand then, Mr. Yule?

Mr. Yule: Yes. My motion is that the recommendation in the President's address be sent on to the Executive Committee, and if approved of by them they report a scheme to the next convention.

The President: You have heard the motion, are you ready for the question?

Mr. Gossler: I personally object to any proceeding that would require two years to make it effective. If we are going to get any benefit out of it, two years is too long.

The President: I think it can be done in one year.

Mr. Gossler: When is it going to be? There will have to be ten members to form a quorum.

The President: Mr. Yule's motion is that the Executive Committee consider this question during the year and report some scheme at the next convention.

Mr. Leyden: I don't believe we fully realize the extent of this change that is going to be brought about by carrying this motion at the present time; there are two kinds of societies, one of electrical engineers, the other a commercial society for the benefit of electric companies. At the present time we are in the happy position of being on both sides of the fence; we have members interested personally and the companies interested personally. If you change that, if you make that a company representation, it is going to mean quite a vital change in this association, and I think it should be thoroughly considered by the members of the association before it is carried. The electrical men in the Dominion of Canada are none too many, and none too many of them are interested in the association to run the risk of any of them dropping out because their companies take the responsibility from them.

Mr. Cary: By referring it to the executive we have fulfilled Mr. Leyden's idea.

The President: I think so. I take Mr. Leyden's remarks to be in the line of the proposition by Mr. Yule.

The motion was then put and carried.

Mr. Wright: I understand your interpretation of the constitution is that it can be amended at the next meeting.

The President: There is no question in my mind on that article, it can be amended at the next meeting.

Mr. Wright: I always had the impression that it could not be amended at one session.

The President: We will have to refer this to the solicitor of the legislation committee. The report of the secretary-treasurer, which was read yesterday, as to the finances of the association, is before you if you have any remarks to make.

Mr. Reesor: I would move, seconded by Mr. Smith, that we adopt the report. Carried.

Mr. Reesor: I wanted to say something about the application for membership form. The way the form reads now is that a person joining the association joins for one year. I think when they join they should be considered as members until they send in their resignation. I think it should be made so that when I once join I am constituted a member, and I should be called on to pay my fees every year until I give notice of withdrawal.

The President: I don't think it is necessary to pass any resolution, but when the secretary gets new application forms, he should have that corrected. We will record it in the proceedings that the secretary is instructed to do that.

Mr. Gossler : I wish to give notice of motion that at the next convention I will make a resolution whereby companies can be admitted to membership to this association, if the executive committee think it wise, or if the association think it wise, at the next convention. The object of that is that we can introduce company membership at the next meeting of the convention, rather than two years hence, if it is thought advisable. I think that this notice is necessary according to the constitution.

The President : I don't think ic is, but I am quite willing to take the notice of motion in case there is any doubt. It requires a two-thirds vote of this meeting to give permission for this notice of motion to be recorded. Are you willing that we should receive this notice of motion? It is subject to the report of the Executive, of course. This is a precautionary measure to save time in case we want to make an amendment next year.

Mr. Gossler : The idea of that is that if it is decided at the next convention by the Executive that it would be desirable to admit companies to membership, we can take immediate action. It is not in any way to antagonize the action of the Association or of the Executive Committee, but it permits of more prompt action.

The President : Are you willing that we should receive this notice of motion?

Carried by two-thirds vote.

The President : The report of the Committe on Statistics is before you, gentlemen. For those who have not heard this report I may say that the report was to this effect, that considerable data had been collected, but no definite action had been taken by the committee during the year. What is your pleasure regarding this report?

Mr. Yule : I move, seconded by Mr. J. J. Wright, that the report of the Committee on Statistics be received. Carried.

The President : The report of the Committee on Meter Inspection is before you. This report is to the effect that during the year the committee has interviewed the officials of the Inland Revenue Department and obtained from them a concession regarding inspection fees to the effect that whenever a meter is inspected within the five years' period, namely, before the five years dating from the regular inspection are expired, 50 cents only will be charged instead of the regular fee.

Mr. Reesor : For any size of meter?

The President : Yes. You have the meter inspected and that inspection is good for five years. If after two years the meter requires readjustment and you have to break the seal and get it re-certified, you pay 50 cents fee instead of paying the full fee. This is in effect now.

Mr. E. Slade : Has any effort ever been made to abolish that fee altogether?

The President : No very determined effort has been made, because I think it would have been useless. I think anyone who has come in contact with the officers of the Department will know it is a useless undertaking. I don't say it could not be done in time, but at the present moment I don't think it would be possible.

Mr. W. Williams : I would move that the thanks of this Association be tendered the Meter Inspection Committee for their successful efforts so far, and that they try and do better, and endeavor to get that inspection fee blotted out altogether.

Mr. Sangster : I would second that. Carried.

The President : The next is the report of the Legislation Committee which was read yesterday.

Mr. Wright : There is only one matter in connection with that report that I think calls for special remark, and that is the suggestion that some method should be adopted to raise the funds in a more systematic manner, a more equitable manner, to meet the expenses of that committee. The electric light companies throughout the province of Ontario have benefitted very largely from the labors of that committee and from the expenditure that has been made, and they have responded, taking them altogether, in a first class manner to the demands that have been made on them for the expenses. But it seems to me a hand-to-mouth method of raising the funds to have to suddenly make a draft and say, here, you are expected to pay so much, without any explanation or any particular arrangement as to the proper method of collection. The report simply suggested that some method should be adopted by which these subscriptions could be brought in in a more systematic manner. That appears to be the only point. It has been suggested that the various companies should be organized perhaps something after the manner of the suggestion in the President's address, so that they will become, as it were, almost stockholders in this thing, and if all contributed, a very small amount from each would possibly suffice. If any arrangement of that kind could be made it would materially lighten the labors of the committee, and especially those of the Secretary-Treasurer, on whom the onus falls of making these drafts and collecting the subscriptions.

The President : This is a very important question. I had hoped the Legislation Committee would have had some scheme ready to submit to this meeting, because they are the ones who know, from their experience, how this thing is to be handled best. It is difficult for a member outside, who has had no experience on the Legislation Committee, to suggest a proper scheme.

Mr. Williams : Wouldn't it be possible to bring in the gas companies in this legislative business? I think they are interested just as much as we are. Of course, a great many of our companies are controlling both; but I am sure this last spring the gas companies were as deeply interested as electrical companies in certain legislation which might have been put through the local house, and I am sure that a number of the gas companies could be brought in and would willingly contribute their share, according to their capitalization or ability, towards permanently looking after legislation.

Mr. Yule : Two years ago, in my report on legislation, I suggested some scheme of this kind being adopted. My idea was that the thing should be sent on to the Legislative Committee and to the Executive, and, if they could so arrange it, that a canvasser could be engaged to visit all the companies and get them to sign an agreement to contribute a specific amount for five years. I think the work this committee has done is worth a great deal of money to the companies of Ontario; it has saved lighting companies hundreds of thousands within the last six months to those who would not have got a dollar if this Conmee bill had not been on the stutute book. It is quite apparent that legislation in the Ontario House has need of careful attention; if it is not attended to we will have trouble, and will get back where we were, and will not get out of there any more. There should be a strong effort made to get a system that will protect us and protect us well. I would move that this question be sent jointly to the Legislative Committee and the Executive Committee to develop a scheme along those lines, to get a canvasser or solicitor to visit all the companies and get them to sign an arrangement for five years to contribute a specific amount to relieve ourselves and relieve them of a good deal of worry and annoyance, and make the committee and their services more efficient.

The President : You wish to authorize the committee to do this?

Mr. Yule : The Legislative Committee would not like to take any action of that kind without the concurrence of the Executive Committee. I am throwing out that suggestion for the members to express their views on. Of course, this thing applies only to Ontario. In Quebec, fortunately, they do not have the anarchists and socialists that we have up here to bother and put the knife into them.

Mr. Reesor : In connection with that, you would have to talk ways and means if the two committees join and promulgate a scheme of some kind. I think it would be perfectly right to get a man to go around and get the companies to become members of the Association at the same time; but it costs money to send that canvasser around, and these committees would have to have some ways and means at their disposal to send a man around, unless they were only going to report to the convention next year.

Mr. Cary : Question.

The President : The motion by Mr. Yule is to the effect that the executive committee and the legislative committee jointly consider this question, and be authorized, if they deem proper, to send an agent around the country to the different companies, to get them, if possible, to sign an agreement to contribute a fixed sum each year for five years, for legislation purposes. Is that your idea, Mr. Yule ?

Mr. Yule: Yes. I don't know about sending a representative around, but let them consider some plan.

The President : Not necessarily that, but I understood you to say that, and as Mr. Reesor says, that is a matter of expense, and we must consider that feature of it.

Mr. Yule : I talked this thing over with Mr. Mortimer some time ago, and he says he will be sending a man around working in the interests of his journal. Probably we might get him to attend to it.

The President : I will make your motion simply to refer the matter to the two committees jointly without any instructions, and they will do what they deem best.

Mr. Yule : Yes.

The President : We cannot tie their hands very well.

Mr. Yule : No.

The President : We will take the motion this way, that the matter of raising money for legislation purposes be left to the executive and legislative committees jointly, with power to adopt whatever means they may deem proper. This motion is seconded by Mr. Williams. Are you ready for the question ?

The President put the motion, which, on a vote having been taken, was declared carried.

The President : The next is the report of the Committee appointed to confer with the Underwriters. As this is a special committee, it will be necessary in adopting this report, to state whether you wish this committee continued or not.

Mr. Yule : I think the chairman of that committee expressed a desire that the committee be continued.

Mr. Gossler : Yes ; it would be advisable to have a committee ; not necessarily the same committee.

The President : The personnel, of course, could be changed.

Mr. Gossler moved, seconded by Mr. Smith, that the report of the committee to confer with the Underwriters be adopted, and that the committee be continued for another year. Carried.

The President : The next is the report of the Committee on Standardization of Accounts. This committee reported they had collected considerable data, and had had correspondence from different sources, and were still at work. I think we will have to adopt the report and continue the committee. Will anyone move that ?

Mr. Wright : If the committee is still at work I would move they be continued, of course.

The President : They were at work up to the time of the convention ; their work is not finished ; they had no report ready.

Mr. J. J. Wright moved, seconded by Mr. Briethaupt, that the report be adopted and the committee continued. Carried.

Mr. Leyden : They promise a report for the next convention ?

The President : I don't know who will compose that committee for the next year. If the same men continue I suppose they will.

Mr. Leyden : I understood the proposition was to continue the same men.

The President : To continue the same committee. The naming of the members will come later.

The President : The last committee is also a special committee for the purpose of defining some standard for arc lamps. This committee report progress, but their work is also unfinished. Shall this report be adopted ?

Mr. Leyden : Excuse me ; that committee was to report on a standard for arc lighting, as I understood. At the last convention we had a discussion, and there were several motions offered to define what is meant by a 2,000 c.p. arc lamp ; and some of the motions were exactly according to the wording of the American Institute of Electrical Engineers, and the London Board of Trade, and all the authority that was necessary to give the thing a standard value, namely, that an arc lamp which should consume 450 watts to the arc should be considered as defining a 2,000 c.p. arc. I think it is all nonsense for us to continue in this way ; if we are going to do business let us do business.

The President : If you had heard the report which was given yesterday you would have seen the reason the committee did not bring in a report. They did not give a final report. Their reason was this, that as there are so many different kinds of arc lamps now being brought out, is was difficult to make a cast iron wattage rating that could be accepted ; and that as this question was in the hands of larger bodies, and engineering societies were still dealing with it, it would be premature for this society to express itself. That was the sense of their report. Does Mr. Gossler move that this report be adopted ?

Mr. Gossler : I move the adoption of the report.

The President : Do you wish the committee continued ?

Mr. Gossler : I don't know as it will do any harm, and it may be a great deal of benefit.

Mr. Gossler moved, seconded by Mr. Simmons, that the report be adopted and the committee continued. Carried.

The President : I will now call upon the Nominating Committee, appointed at yesterday's session, to report.

Mr. Mortimer : I have been asked to read this report. It is as follows :

For President : A. A. Dion, of Ottawa.

1st Vice-President : E. E. Cary, St. Catharines.

2nd Vice-President : P. G. Gossler, Montreal.

Secretary-Treasurer : C. H. Mortimer, Toronto.

Executive Commitee : First five—A. B. Smith, O. Higman, D. R. Street, J. J. Wright, B. F. Reesor. Second five—F. W. Simmons, A. Sangster, John Yule, Edward Slade, H. R. Leyden, Wm. Williams (Sarnia), J. F. H. Wyse.

Committee on Statistics : J. F. H. Wyse, J. A. Kammerer, A. A. Wright.

Committee on Legislation : R. O. McCullough, J. J. Wright, B. F. Reesor, C. B. Hunt, John Yule, H. R. Leyden, A. A. Dion, W. H. Breithaupt. (With power to add to their numbers.)

Committee to Confer with Underwriters : P. G. Gossler, Edward Slade, A. A. Dion, Alderman Sadler, A. Sangster.

Committee on Arc Lamp Rating : O. Higman, P. G. Gossler, Fred Thompson, John Yule, J. F. H. Wyse.

Committee on Meters : (Same committee continued).

Committee on Standardization of Accounts : (Same committee continued), Mr. Hart, chairman.

The first name on each case to be chairman of the committee.

The President : You have heard this report. You understand thoroughly that this is merely a suggestion on the part of the committee ; it is done for the purpose of guiding the members and helping them in their choice ; it is not binding on any member of the Association. Other nominations for any of the offices or committees are quite in order. The election of officers and the executive committee will be taken up to-morrow, but the other commiteees will be selected now. The selection of the Nominating Committee of a Committee on Statistics is Mr. J. F. H. Wyse, Brantford, Mr. J. A. Kammerer, Toronto, and Mr. A. A. Wright, Renfrew. Are there any other nominations for this committee ?

Mr. J. J. Wright : I think in the case of this committe it is not open to change.

The President : It was my impression that the chairman had the nominating of the committee, but Article 18 of the Constitution says : "The president shall nominate a committee of three to strike the standing committees for the following year and define their respective duties, the report of the committee being considered at a subsequent sitting to its introduction." That would mean to-morrow. This is an article of the constitution that has been ignored in the past. I think the President has appointed the committees on the recommendation of the Striking Committee, but to be on the safe side I would rather have the convention confirm the nomination. Is it your pleasure that the Committee on Statistics be as recommended by the Nominating Committee? Carried.

The President: The next is the Committee on Legislation: R.O. McCullough, J. J. Wright, B. F. Reesor, C.B. Hunt, John Yule, H.R. Leyden, A.A. Dion, W.H. Breithaupt, with power to add to their number. Does this meet with your approval? Carried.

The President: The next is the Committee to confer with Underwriters. The committee recommend Messrs. P. G. Gossler, Edward Slade (Quebec), A. A. Dion, Ald. Sadler and A. Sangster. Carried.

The President: The next is the Committee on Arc Lamp Rating. The committee recommend Messrs. O. Higman, P. G. Gossler, Fred Thomson, John Yule and J. F. H. Wyse. Carried.

The President: The next is the Committee on Meters. The same committee as last year is recommended: Messrs. A. A. Dion, E. E. Cary and J. J. Wright. Carried.

The President: The next is the Committee on Standardization of Accounts. The same committee as last year is recommended: Messrs. D. R. Street, P. H. Hart and A.A. Wright (Renfrew.)

The President: Mr. Hart has taken no action at all, and he has not been heard from for a number of months; I don't know where he is.

Mr. Gossler: He is down in the Lower Provinces.

Mr. Street: Although I was named first on that committee, Mr. Hart was chosen chairman at a subsequent meeting, on account of the paper he contributed to the association last year. I might say that the committee arose from the discussion on his paper and the appointment from that, and out of deference Mr. Hart was appointed chairman, and if he is going to continue a member of the association and a member of that committee, I, for one, would like to see him still chairman, although I see my name is mentioned first.

The President: The recommendation of the Nominating Committee is that the first name mentioned on each committee will be the name of the chairman.

Mr. J. J. Wright: That is according to the constitution; it is just as well to have the constitution defined. I think we are practically unanimous in accepting these committees. Article 19 says: "The first person named on any committee shall act as chairman until the committee is called together, when they will elect their own chairman."

Mr. Reesor: That should be that the first name on the committee should be the convenor.

Mr. J. J. Wright: If you take the article before that, and take that word "strike," it must mean to elect, not to nominate. It is a very ambiguous term. The considering of it would mean the announcing. If it is thought well to introduce any amendments to the constitution at the next convention, I would move that some of these articles be amended in a certain degree to make them plainer.

The Pretident: There are several amendments required. Mr. Street requests that the order of the names be changed on this committee, and that Mr. Hart's name be placed first. Are you willing to alter your report in that way? He wishes to have Mr. Hart continue as chairman because he was chairman last year and took the initiative in that.

Mr. Wright: I suppose the committe would have to be called together again to do that.

The President: It occurred to me that Mr. Hart took no action for some time, and he might not in the coming year. That would leave only two names. It might be advisable to add another name.

Mr. Street: I think it would be very wise.

Mr. Wright: Would you suggest a name?

Mr. Street: No, I don't think I can.

Mr. Smith: I would suggest Mr. Higman, of Ottawa

The President: I think some gentleman who has to do with central station accounts should be put on that committee.

Mr. Gossler: I think the matter as brought out by Mr. Wright is a matter that should be decided now, as the precedent that is being established here by the action of the executive placing before the association the committees for approval is, if I am not incorrect, contrary to custom. The constitution has been interpreted here to convey that the executive should receive the nominations for the committees, and then present them to the association. I think in all legislative bodies or all organizations that this is one of the privileges of the executive. Now the precedent has been established in this association for the executive to place those committees before the association for its approval. It seems to me that is contrary to precedent and custom, and I think we had better decide now whether we want to interpret the constitution to mean that of our own association and go contrary to custom, or stick literally to the constitution.

The President: It is very difficult to interpret this article, and for that reason I thought I wonld keep on the safe side by getting the approval of the meeting.

Mr. Wright: But you establish a precedent which might be inconvenient at some future time.

The President: The article says they shall "strike"; if you take that to mean they shall "elect," what is the use of considering their report at a subsequent meeting?

Mr. Wright: That is probably antagonistic to the other word.

Mr. Yuie: I think the meeting would have power to amend the committee's report in any event.

Mr. Gossler: I don't think so, unless there was an illegal appointment. Is it not customary for the executive to have the power of appointing committees in organizations such as this?

Mr. Wright: That certainly is the custom; it is thoroughly well safeguarded, and the very fact that the President may nominate a committee of three clearly shows that. Now, of course, he is given the initiative in the first place; he can select three men whom he thinks will nominate and strke the committees rightly in the interests of the association; then there is the further safeguard that three good members of the Association would not in all probability strike committees that are not in the interests of the Association. The President takes the initiative; the three men then strike the committees, so there is a safeguard there between the executive and the three members of the committee; at the same time it does not leave it open to be all torn to pieces by the association generally.

The President; Article 21 says Todd's Parliamentary Practice shall govern.

Mr. Reesor: As far as I understand the parliamentary practice, I think the select committee strikes the standing committees; the standing committees are then reported to the full body and usually they are adopted, but it is not imperative; the whole council can tear them to pieces or add to them I think the select committee have the nominating of them, and it is the usual practice, but not imperative, to adopt them

Mr. Gossler: I understand a motion could be introduced whereby the committee could be increased in numbers.

The President: So far there has been no amendment. The committee have been accepted just as they are. But I have asked the Nominating Committee to amend their report themselves by adding a name to the Committee on Standardization of Accounts. If they consent to do that all right. In any case, no objection has been taken to any of those committees.

Mr. Wright: That is not the question; it is simply to define the article in the constitution to avoid any further trouble. According to article 10 of the constitution we are empowered to amend this constitution at this session, so I will give notice of motion, with the consent of two-thirds of the members present, that this word "consider" in Article 18 shall be changed to "announce." This, of course, will be considered at to-morrow's session.

The President: Do you consent to receive this notice of motion? I think we might leave this matter of amendments until our next sittings, to allow the members to become familiar with the articles.

Mr. Wright: If we do that it prevents any amendment being made at this session. It is really unimportant, as far as that goes; there is nothing hinges on it now, but at the next convention there might be something very important come up. If it is thought more advisable a small committee might be appointed to revise the whole constitution and report at the next convention.

The President: I think so. I have had occasion to refer to this constitution during the year, and I think it is very incomplete.

Mr. Williams: I don't think the amendment, with the present constitution, would be got through this session any way; it requires, after permission being granted, after discussing, that the amendment be submitted to a committee of five named by the chairman; the report of the committee cannot be considered on the same day on which it is introduced. If you take your notice now you can't do anything till to-morrow; to-morrow you would refer it to a committee which could not report.

The President: It would be necessary for the committee to report this afternoon, and we could not take it up till to-morrow.

Mr. Breithaupt: I would move that the chair appoint a committee of three to look into this matter and report at the next meeting, if possible, or to-morrow morning.

The President: If they report to-morrow morning we cannot consider it at this session.

Mr. Wright: Would you refer the matter to the Executive Committee to bring in a recommendation at the next convention?

Mr. Breithaupt: The only reason why I mentioned three is because the executive is rather large, and three would be better able to get together and do the business. I am willing to change it to the executive if Mr. Wright thinks so.

Mr. Wright: It is a question for the majority of the members.

The President: Unless it is reported upon to this convention this afternoon, we cannot consider that at this convention.

Mr. Breithaupt: If that is not the proper interpretation, we might have a motion that it be left to the next session, and the change then be adopted. I would move that.

The President: It is moved by Mr. Breithaupt, seconded by Mr. J. J. Wright, that the Executive Committee be requested to suggest necessary amendments to the constitution at the next convention of the Association. Carried.

The President: The next order of business is the reading of papers.

Mr. Smith: Before that, I would like to move that the usual grant be given to our secretary as last year.

Mr. Leyden: I second the motion.

The President put the motion, which, on a vote being taken, was declared carried.

The President: I would call on Mr. Camp to read his paper on "The Use of the Dynamo and Storage Battery in Telegraph Offices." (See page 170).

Mr. Camp: Before reading the paper I would like to call your attention to an error made in fig. 2 of my paper; it was a mistake on my own part. You will find by one of the circles designating dynamos on the left hand side, it is marked "negative 350 volts"; this should read "positive"; the next one should read "negative 350 volts." The four circles should be lettered m,n,o,p, commencing on the left hand side. It is necessary, in order to understand the inspection of the diagram.

The President: You will agree with me that this is a very excellent paper on the subject. It has always been a difficult matter to get papers on telegraph subjects. This time we have secured a valuable one, and the subject is fully and well treated. The telegraph business, while comparatively an old branch of the electrical science, is, as we may see by the descriptions given by Mr. Camp, by no means at a standstill, but developing rapidly as the other lines of electrical application. The paper is open for discussion.

Mr. Camp: I would like to hear some expression from Mr. Smith on this subject. I certainly expected to have his experience; he has probably been more largely concerned in working dynamos as applied to telegraphing than I have. It is only in the present year that we have installed our own plant in Toronto. I think he could give a good deal more information on the subject than I have.

Mr. Smith: Mr. Camp's paper does not admit of much discussion; he has covered the ground so thoroughly and so concisely that there is nothing left to be said. As an historical paper, we are very glad to have it for the Association. We have nothing of its kind in our papers, and having this from Mr. Camp, who is so well qualified to write, we are glad indeed to have it. In speaking of our experience with dynamos and motor generators for telegraph work, I have a very vivid recollection of the first machine made; I think it was in 1882 it was brought out, and I think Mr. Wright had a good deal to do with it, and when the machine was first connected up, we stood by in fear and in trembling wondering what it was going to do, and finally the thing seemed to go off allright, and out of that developed the two large motor generator plants we now have in use in Toronto and Montreal. Subsequent development and improvement in the storage battery developed the fact that they are superior to the motor generator for most classes of work, and would to-day be adopted, I think, in all the larger places. I would move a vote of thanks to Mr. Camp for his paper.

Mr. Wyse: I second that.

The President: I have much pleasure, Mr. Camp, in tendering the thanks of the Association to you for your valuable paper. Yesterday we had a paper on power factor on which there was a little discussion, and the further discussion of it was adjourned until to-day. I would like to hear from any members on this subject. I think it is a very excellent paper which should be discussed.

Mr. Gossler: I suggest that you call on Mr. Leyden for an expression of opinion. He has had considerable experience in the use of induction motors, alternating current arc lamps, and synchronous motors, and is, I am sure, very well qualified to speak on the subject.

The President: We should be pleased to hear from Mr. Leyden, I am sure.

Mr. Leyden: I have not had an opportunity to read over this paper of Mr. Leonard's with any care, and anything that I can say would just be a sort of general expression of what my opinions might be, and I don't know whether they would be covered by Mr. Leonard's paper or not. The only thing I can say is this, that the keeping of your power factor, particularly at certain hours of the day, as high as possible, is of very great importance to the operation of your station, especially where you are supplying incandescent lights from the same generators as you are the motors and arc lights. It becomes a question that you have to figure on, on almost every installation of motors and lights and everything you put in, to find out and anticipate as nearly as possible what its effect will be on your whole service. On the other hand, the question of putting in induction motors and alternating arc lamps on your circuits has so many manifest advantages that you can afford to put up with some of the disadvantages in order to obtain the cheapness and reliability of operation that you certainly do secure by these means. On our plant we are changing all our arc lighting service over from direct current to series alternating current for our street lighting. So far, we have changed about half of it to series alternating current enclosed arcs. The power factor of that we find varies to a very considerable extent, according to the number of lamps we put on our circuit, but as far as the reliability of our service or economy of operation is concerned, it is all that we anticipated when we adopted that method. As compared with the series open arcs which we had before, it certainly saves a very considerable percentage in the amount of power it takes in your lighting service ; it also saves you a very considerable expense in the operation of your circuits ; by that I mean both the expense of trimming, the expense of carbons and the expense of maintenance of the arc lamps. The series alternating arc lamps that are on the market to-day are quite simple and reliable in operation and cheaply repaired. We have had perhaps six months' experience with series enclosed arc lamps. While, of course, you necessarily have your troubles in any electric plant, you have nothing at all serious. The effect of this power factor and of these alternating arc lamps on the rest of your service amounts to about this, we have made a number of tests on our arc lighting circuits, and we found that our power factor will vary according to the number of lamps that we connect on that circuit. If we get all the arc lamps on that the circuit will possibly carry, we get a power factor of about .85, and it drops down very rapidly as you take arc lamps off your circuit. We run a pressure of 2,400 volts ; on that we should be able to burn, theoretically, some 33 arc lamps, series enclosed ; if we got the full 33 on, I think we would have a power factor of somewhere about .90 or .91, but we find that the circuits won't work well when we put the full number on, and we get more satisfactory operation by cutting it down to about 30 ; that has also the effect of reducing your power factor down to about .85. So it is a question you have to consider on both sides, whether you can put up with the annoyance of this power factor in order to save the expense of operation of your plant. I think the expense which you do save and the economy which you gain, and the simplicity of your system, certainly overbalances any evil effect of this low power factor, especially when you take into consideration that at certain times of the day when this power factor annoys you most, by having some synchronous motors on your line you can to a large extent over-balance it. Synchronous motors in large sizes I consider to be a very valuable, very handy, and convenient piece of apparatus to have on your circuits. This is especially true for motors which you must have in your own premises and under your own care, where you can regulate and operate them to the best advantage, or in places where you have some control over them through the attendant who operates them. On the other hand, my idea of small motor work is that the induction motor is much simpler ; and while it has a low power factor in a great many cases, particularly on partial loads, still it is a commercial problem, and you have to balance one advantage against the other ; and generally speaking, the result of our experience is this, that in large motors, and particularly where you have steady loads, I should employ synchronous motors ; where you have distributed power in a factory where you want to divide it up into small units, the manifest mechanical advantages of the induction motors predispose me in their favor. I am talking in this general way because I have not read Mr. Leonard's paper with sufficient care to take it up in any detail.

The President : Might I ask a question or two. Apart from the lowering of the power factor induced by the use of alternating arc lamps, are they a disturbing element on your circuit to any extent, assuming you are running incandescent lights off the same generator ?

Mr. Leyden : No, I should not say that they are. We cannot notice any effect of these arc lamps on our service in general, any more than, well, not as much as you would by starting a motor up to drive a lot of arc machines ; that is, we throw one arc light circuit on after the other at the time of starting ; the effect on our service of that is less noticeable than would be the effect of starting up a large motor to drive a lot of arc machines, and the attendant at our power house has to be watching his business, and gradually raise his field current on his generators in order to compensate this. By careful attention on the part of the swithboard attendant, he can put those arc lights on so that there is no serious interference with our incandescent lighting. I presume if we throw all those arc lamps, say 500 series alternating arc lamps, on at once, it would produce quite a very marked disturbance, but we don't notice it in our present system.

The President : Another thing I wished to ask is whether, in the case of synchronous motors used on your circuits, or more especially in your station within your control, whether you can regulate them day in and day out, as a general thing, so as to counteract drop, whether that is a practical quality of the motor that you can do that regularly.

Mr. Leyden : I should say that would depend to a very great extent upon the character of the load on your synchronous motor. If you have a rapidly fluctuating load, I have found the only way is to set your field current so high that it cannot be pulled out of step by any of the sudden jerks that come upon it, and let it run at that. If your load is steady all the time, you undoubtedly can operate that synchronous motor to very great advantage to the rest of your service. At the time that your power factor is low, and you set the field current on high, it will compensate for a great deal of the lagging current on your other service ; and I should say that in most cases where you have synchronous motors the loads are steady, and under those conditions you can operate a synchronous motor so that it is of very marked benefit on the rest of your service.

The President : Have you anything further to say on the subject, Mr. Gossler ?

Mr. Gossler : I don't know that I have anything further to say on the subject ; it is pretty broad, and a subject that could be talked on for a very long time, but I don't think I will say anything on it now.

The President : How about Mr. Leonard ?

Mr. Leonard : I have very little more to say. In what I said yesterday in my paper, and the discussion we had yesterday afternoon, I think I have expressed myself pretty fully. But it has certainly pleased me very much to hear from Mr. Leyden, as it brings a class of information to central station managers which is just exactly what we are looking for; particularly those that are either in the power business at the present time or contemplate going into it ; and I wish the discussion could have been a little broader. I was very much interested in what Mr. Leyden said about arc lamps ; it is a matter whice I have not personally had a great deal of experience with, but I think it is one of the branches in connection with alternating stations which is certainly going to be a matter of a good deal of importance. They are trying to simplify our stations to the utmost, and we may some day realize the ideal of a single type of generator, as I said in my paper, with interchangeable parts, and one type of reserve apparatus—everything in shape—so that an accident is not going to cripple the whole system. Besides these advantages, there is the advantage of the reduction in expense of operation. I think the arc lights can be operated at very much less cost in connection with a large alternating current generator, as compared with the necessarily small direct current machines. I don't know, Mr. Leyden, what system of compensation you are using. Is it the choke coil type of apparatus ?

Mr. Leyden : Yes, the choke coil.

Mr. Leonard : I think I have nothing further to say.

Mr. Sangster : I may say one year ago about this time we adopted the series alternating enclosed arc lamps in our station ; we didn't put in very many of them, about 90, I think, at that time, and we found them very satisfactory indeed. We purchased them from the General Electric Company, and we are using the transformer. We can put on 12 or 15 lights on the line and it does not seem to affect it in the least. We sometimes have to do that. We have two lines, 45 on one, and 47 on the other, using about 80 volts each, and we find it very satisfactory, both as to expense and care of the lamps and the general maintenance and cost, generally running one week on half a carbon ; one carbon does two weeks. And we find it an advantage in every possible way. As far as the power is concerned, I really think it does not seem to take any more power than we were using on the straight current before, and I think that station managers should look into this a little more. Of course, there is no doubt they are improving on the lamps every day.

Mr. Leyden : There is an interesting part of this alternating arc lamp business that does not pertain exactly to the subject of this paper, but I think it would be of interest to the members of the Association. There seems to be considerable talk, and there has been for a number of years, amongst the electrical fraternity, about the inefficiency of an alternating arc lamp as a light-giving device ; that is, a great many prominent electrical engineers and scientists tell us that you don't get as much light out of the alternating arc light with the same consumption of watts as you do out of the direct current. However that may be, I have become thoroughly convinced that for the same number of watts consumed in an alternating enclosed arc lamp, having a proper reflector above it, that you get a more satisfactory street illumination than you do out of the old-fashioned open arc lamp, direct current. We have had them in Hamilton burning since last Christmas, and we have not had one complaint about the amount of light or the quality of it ; on the other hand, we have had a great many people compliment us on the greater satisfaction of illumination that we have. We find this, that while the light apparently directly underneath the lamp is not as bright as with the old open arc, yet it is even and no shadows ; it is evenly distributed around underneath the lamp, and up and down the streets you will find a more even distribution of light, and after you get off, say beyond 100 feet, there is apparently more light on the street than there is with the old arc lamp ; so that the difference, particularly in the amount of light, is not noticed ; that is, there is no dissatisfaction with the amount of light by putting in these series enclosed arc lamps. There is another advantage which is quite marked, that is, that you can hang them low down, close to the street, and in that way increase the apparent illumination on the street without having any blinding effect on the people looking directly at them. The source of light is apparently so much larger that you can look right at the lamp without being blinded, and people can drive under the lamps and see where they are driving, which is not the case with the old arc lamp. I mention that as a point which is often brought up against the use of these lamps.

The President : I would like to hear what has been Mr. Sangster's experience on that—whether there has been any complaint by the people as to the difference in the light.

Mr. Sangster : I would say that the remarks Mr. Leyden has made would apply, that it is the same with our city. We can lower the lamps and the light is diffused much more than with the open arc lamps. They like it much better. We get the light more direct with the open arc, but the enclosed type seems to diffuse the light much better and people are generally much more pleased with the lights since we put them up, and every day we hear expressions as to how nice it is to what it used to be, and yet we had a very good light before in our open arcs.

The President : Do you have choke coils on in the station ?

Mr. Leyden : Yes, we have them in our station.

The President : That means a good deal of wiring—many circuits.

Mr. Leyden : We had our circuits divided up practically in the same way as before, so that it didn't mean much difference to us.

Mr. Leonard : I was going to ask Mr. Leyden what his opinion was of operating arc lamp circuits with the transformers or choke coils distributed around on different parts of the circuit, as to whether there is any indication in his experience that such an arrangement would be objectionable in any way ? Can the transformers, in other words, be relied upon to perform the work laid out for them without any attention whatever?

Mr. Leyden : We don't use the transformer method in our service, so I am not prepared to speak, but in a number of places I have visited where they do use that method, they have them distributed in that way ; instead of having the transformers right in the station they are put out in vaults around in different sections of the city, and then they have an arc light inspector whose business it is to go there and start them up and look after the lights while they are burning, and if anything goes wrong it is his business to return to this vault and see what has happened. In my own experience I don't know whether it is advisable or not.

Mr. Sangster : We have not had any trouble with the transformers in the station ; we have just two lines running out from them, a line from each transformer, and they are supposed to carry 50 lights, and as I say, it is very satisfactory ; 12 or 15 lights put on we do not seem to notice—it seems to pick up so quickly.

Mr. Reesor : I would move that a hearty vote of thanks be extended to Mr. Leonard for his very able and useful paper. I think it is one of the best papers we have had read at our conventions yet. (Carried.)

The President : I have very much pleasure in tendering to you, Mr. Leonard, the thanks of this Association. The paper is not only a very good one, but the discussion which it has provoked has proved most interesting. As you said a while ago, that is the kind of information that central station men want at the present time, and therefore what has been said to-day has been of value, I am sure, to the members of the Association.

On motion of Mr. Reesor, the convention adjourned to meet at 2:15 o'clock p.m.

AFTERNOON SESSION.

The President, in the chair, called the convention to order at 2.30 o'clock, p.m.

The President : The next order of business is the paper by Mr. Blair, of the Quebec Railway and Lighting Company, of Quebec, on a railway subject.

Mr. W. H. Browne : I would ask leave to move to amend the regular order of business and substitute therefor the election of officers. I understand that the Nominating Committee have their ticket prepared to offer, and action can be taken upon it very readily and we can dispose of that part of our business. I ask for a seconder.

Mr. Ross : I second the motion.

Mr. J. J. Wright : Would it be competent to change the order of business to that extent ? The day is set apart in the programme, and it has been the usual custom to elect the officers on the morning of the last day. Any member of the Association who is unable to be present now, and could be present to-morrow, might reasonably take exception to altering an important part of the proceedings in that way. Not that I think it will make the slightest difference to the election, but simply as a matter of proceedure.

Mr. Browne : I made my motion with full knowledge of the fact that that order of business was down for to-morrow. I did not understand that our order of business was the matter of a day. I thought it was competent for us to move for the amendment of the order at any time, and, believing the matter of nominations is practically all settled except the formal act, I thought it would save that much time.

Mr. Leyden : The object of this motion, I believe, is to arrange matters so that we can finish up our convention this afternoon, instead of carrying it over until to-morrow morning. We have only a small amount of business to transact, and one paper, I believe, to read, and if we could get through this afternoon there is no use carrying it over until to-morrow.

Mr. Wright : I think there is not the slightest doubt but that the business of the convention could be well and satisfactorily arranged this afternoon, but the city of Kingston have invited us here, and have entertained us most hospitably, and I think it would be very derogatory to them, and would appear to me to be a slighting of their reception, if we come here with the intention of holding a three days' convention and at the end of the second day we turn the whole thing up and go home.

Mr. Browne : I had better perhaps express myself more clearly concerning my motion. I did not know it was necessary to explain why I wished to change the order of procedure. I understand there are several members here who would like to adjourn this afternoon in order that they may still further enjoy the hospitality given by the city of Kingston, and then resume business to-morrow morning, and it was with a view of giving effect to that that I made my motion for the election of officers now.

The President : The holding of the election of officers now, to be followed by an adjournment until to-morrow morning, would practically close the convention.

Mr. Browne : There is another paper to be read.

The President : I know, but the attendance would be small ; I am afraid there would be a general exodus of the members.

Mr. Wright : If there is any special reason for adjourning this afternoon, if they wish to take up something else this afternoon, it would be quite in order to adjourn this session of the convention till to-morrow morning, and take up the business then, but I think it would be considered a very impolite act to close the convention to-day and go away. I do not mean to say it would make the slightest difference financially or in any other way to the city of Kingston, but when people have done their best for us and given us a good time, I do not think it is exactly the thing to pick up our traps and leave.

The President : I may say, in justice to the citizens of Kingston, that they have offered us a visit to the penitentiary to-morrow afternoon, and asked us to attend the military tatoo given by the military band to-morrow evening.

Mr. Browne : The main purpose for making the motion for the election of officers by me to-day, is that I am told it will be practically unanimous. There will be left then for to-morrow simply the matter of reading the paper and the discussion of it, without any interference with it whatever, and the great desire of the majority this afternoon is to adjourn and take a visit on the river again.

The President : If there are no further remarks we will take the sense of the meeting.

Mr. Leyden : That being the case, I would most strenuously object to holding the election this afternoon. They have been scheduled in the programme you have sent out to be held to-morrow, and it has always been the usage of this Association that we should hold our election on the last day. I do not see any use of bringing them on now if you are going to continue the convention to-morrow morning.

The President : The motion is to take up the election of officers. Do you move an amendment ? It is a question on which I feel rather embarrassed, because, while the convention can order me to do whatever they like by a majority vote, I feel that I have a contract to fulfil here and a programme to follow, and whatever is decided, I would like to be decided by a very large majority, if not a unanimous one ; in fact, I would rather have it unanimous and then we could share the responsibility together. I do not believe, though, that there are any members who are not here to-day that will be here to-morrow morning, so that it will really make no difference. Are you ready for the question, gentlemen ? We will now put Mr. Browne's motion that we should change the order of procedure, and take up the election of officers now.

The vote being taken, the President declared the motion carried by a majority of two.

Mr. Leyden: I move, seconded by Mr. Wright, that we adjourn until to-morrow morning.

The President : This motion cannot be discussed.

The President put the motion, and, on a vote having been taken, declared the motion carried, seventeen voting for and ten voting against the motion.

At 2.45 the convention adjourned until Friday morning at 10 o'clock a.m.

At 3 o'clock p.m. the members of the Association and their friends left on the steamer New York for a trip amongst the Thousand Islands, proceeding as far as Alexandria Bay. A unique feature of the return trip was the assembling of the members, at the call of the president, in the dining room of the steamer at 7 o'clock p.m., at which time Mr. Blair read his paper entitled "A Railway Subject, Giving Several Curves Showing up the Average Power During a Day, and Maximum and Minimum Requirements for Power Called for on the Quebec System." (See page 179.) The reading of the paper was greeted with applause.

Mr. Wyse : How long has the road been operated ?

Mr. Blair : Three years. The heaviest wire on any commutator is three-eighths of an inch.

Mr. Wyse : Is your traffic heavy as well as your grades ?

Mr. Blair : On those grades it is ; the heaviest grades carry the heaviest traffic in town. There has not been a commutator flash or buck on the road for eighteen months. The water and slush in the spring time have never given us any trouble, it is the hard snow in the winter. $16,300 is the total cost chargeable to snow. I may say in our company we have no depreciation account, everything goes in to maintenance account.

Mr. Wickens : Depreciation and cost of repairs go in together.

Mr. Blair : They go in together.

Mr. Browne : That is, you keep the road up to the standard ?

Mr. Blair : Yes, up to the standard for railways.

Mr. Wyse : Do you actually have to cart the snow away ?

Mr. Blair : In some cases we have to actually cart it away to some convenient place for the time being, and then the next day take it away permanently.

Mr. Wyse : Then you have to cart it twice ?

Mr. Blair : In almost every case we have to cart it twice. In some cases, without exaggeration, there are four feet of snow above the top of the car ; that, of course, has got to be shovelled out. A car will run into these drifts. Anybody who knows Quebec will know the point I refer to, Chateau Frontenac.

Mr. Wyse : Where do the foot passengers go ?

Mr. Blair : They have to come in along the car tracks.

Mr. Gossler : You pay the tenants fifteen cents per lineal foot for the removal of the snow how often ?

Mr. Blair : Once a year.

Mr. Wickens : What is the length of your day ?

Mr. Blair : Eighteen hours.

Mr. Wyse : The power supply is water power, is it not ?

Mr. Blair : Yes.

Mr. Wyse : What do you use the rotary converter for ?

Mr. Blair : For the railway at St. Anne-de-Beaupre, five hundred volts are fed into the wire. I may say there are eighteen stops made in twenty-one miles. We have as many trains on now as we can put on in that section. They will, in all probability, have another line laid in the near future.

Mr. Edwards : What kind of brushes do you use ?

Mr. Blair : We use the Valley Whiting.

Mr. Wyse : What pressure do you put on each brush ?

Mr. Blair : That depends on which car it is. We keep the hill cars and level running cars separate on our road.

Mr. Wickens : You run the same car over the hill as on the level ?

Mr. Blair : Yes, but we are drawing more current than on the level.

The President : I want to say, gentlemen, in justice to. Mr. Blair, that he advised the committee on papers a very short time ago that his paper was not written, and owing to pressure of work he was not able to write it, and the chairman of the committee on papers consulted me and we concluded that as we had decided to have a paper on a railway subject, and as it was too late to ask anyone else to write it, he should insist that Mr. Blair should write this paper. This seemed to be a little cold-blooded, but the interests of the association required it, and we were firm, and to our great satisfaction Mr. Blair replied that he would write it. That is not more than a couple of weeks ago, and this work has been done since, and we are certainly very much indebted to Mr. Blair.

Mr. Wyse : You must have a good method of keeping records.

Mr. Blair : We keep records of everything.

Mr. Wyse : You keep the records by numbers ?

Mr. Blair : By numbers of the car and so forth. The men who do the work keep the records during the month, and I take the whole of them and enter them in my own book once a month.

The President : That shows the value of keeping records.

Mr. Browne : It shows the value of systematic attention and records. I certainly think the thanks of the association are cordially due to Mr. Blair, and I move that a vote of thanks be passed to him.

The President put the motion, which, on a vote having been taken, was declared carried, and the thanks of the association tendered to Mr. Blair.

THE BANQUET.

The large dining hall of the Hotel Frontenac was none too large to accommodate the members of the Association and invited guests who assembled on the evening of August 30th to participate in the annual Association banquet. Mr. A. A. Dion, the President, presided, and gracefully discharged the duties of toast-master.

After the singing of the National Anthem in response to the toast to Her Majesty the Queen, the United States Vice-Consul, Mr. Twitchell, was asked to respond on behalf of the President of the United States, which he did in an able and interesting manner. Mr. Wm. H. Browne, in a pleasing speech, replied on behalf of "Our Association." Excellent speeches were delivered by Mayor Minnes and Alderman Donnelly on behalf of the "Corporation of Kingston." The names of Messrs. Simmons, Nickle, and ex-Alderman Behun were associated with the toast to "Our Guests." The toast to the "Allied Interests" drew eloquent replies from Messrs. M. H. Folger and E. E. Cary. Mr. Pense, editor of the Kingston Whig and President of the Board of Trade, responded for the Press, and Mr. Shannon, city clerk, formerly editor of the Kingston News, for the Ladies. Alderman Donnelly favored the company with a recitation, Alderman Craig contributed a song, the local military band and the Italian orchestra, engaged by Mr. Cary, each contributed a number of pleasing selections.

THIRD DAY.

At 10 30 o'clock a.m. the convention resumed.

The President : The first thing on our programme this morning, to carry out the resolution passed yesterday, is the election of officers. The Nominating Committee have reported yesterday suggestions as to the election, and I wish to repeat that suggestions made by the Nominating Committee are in no way binding on any of the members, but nominations can be made and received for any of the offices or the committee. The first office is that of President, and the Nominating Committee have recommended your humble servant. (Carried.) For First Vice-President the Nominating Committee suggest the name of Mr. E. L. Cary, St. Catharines. (Carried.) For Second Vice President, the committee recommend Mr. P.G. Gossler, Montreal. (Carried.) For Secretary Treasurer they recommend Mr C.H. Mortimer, Toronto. (Carried.) With regard to the Executive Committee, as you know, five of the old members are to be re-elected, after which five more members are elected. Of the old Executive Committee the Nominating Committee wish the following to be retained: Messrs. A. B. Smith, O. Higman, D.R. Street, J. J. Wright, B. F. Reeson. Carried. Now there are five other members of the Executive who may be chosen from any members of the Association. The committee suggest Messrs. F. Simmons, A. Sangster, John Yule, Ed. Slade, H. R. Leyden, W. Williams, and J. F. H. Wyse. There are more names suggested than we require ; we only want five names to complete the list. I presume from this that the Nominating Committee wish us to make a choice from these names.

Mr. Ross : I nominate Mr. Camp, of the C. P. R. Telegraph Co., Montreal.

The President : I would ask Mr. Purcell and Mr. Reesor to please act as scrutineers. Are there any other nominations for the committee before we close it ? Those going out on last year's Executive are Messsrs. Carrol, Black, Sangster, Wyse and Browne. Mr. Sangster and Mr. Wyse are proposed in this list.

Mr. Wyse : Would it be in order for me to nominate anybody else ? If so, I would like to nominate Mr. Browne.

The President : I have no objection. I want to give the fullest freedom possible.

Mr. Wyse : Then please add the name of Mr. W.H. Browne.

Mr. Cary : I hope it will not be improper to call to your mind a short speech that was made at the banquet by Mr. Simmons. Some of you may not recollect it, but those of us who have endeavored to do a little here before the convention in Kingston realized that we could not get help for love or money, could not get plumbers, decorators, or anybody. Mr. Simmons took off his coat and worked like a day laborer. We wanted him to use his wits, but he had to use his hands. I feel that, if you all know the value of his services, you will only be too happy to put him on the Executive. And, in addition to that, he lives near Ottawa for the next year.

The President : While the ballots are being counted, we might improve the occasion by taking up the selection of a place of meeting.

Mr. Wyse : I would suggest that Ottawa be the place for the next meeting, and the approximate date as soon after the adjournment of parliament there as possible.

Mr. Leonard : I second that.

The President : Do you wish to have the date in the motion or leave that separately ? There might be some discussion as to the best date.

Mr. Wyse : Keep that separate.

The President put the motion that the convention be held in the city of Ottawa next year, which, on a vote having been taken, was declared carried.

The President : I wish to say this, that I am very much pleased indeed that the convention should be in Ottawa. I didn't make you any formal invitation or press you to come to Ottawa simply because I thought that, having done so once and not being able to carry out the programme, we should not stand in the way of any other place which would like to get the convention or which was entitled to it. I wished, while we were desirous of having it in Ottawa, that the suggestion should come from outside, as it did. That was my reason for not extending to you an invitation. But let it be understood that we are very happy to have you come to Ottawa, and we will do our best to entertain you and give you a good convention. As to the date, Ottawa is peculiarly situated in that way. The sessions of parliament bring many to the city, and it taxes the hotel accommodation to the utmost, and during the last few years the sessions have extended far into the summer. Parliament adjourns late in June and sometimes well into July ; for that reason the old favorite date, about the end of June, could not hold in Ottawa. I don't think it would be safe to select any date previous to the 15th of July. I think any time from the 15th of July on would be acceptable to us in Ottawa. It would be a matter of which would be the most convenient date for the members to get away. We might hear some expressions of opinion on that point.

Mr. J.J. Wright : I would move that the matter be referred to the Executive Committee, having in view what you say.

Mr. Kammerer : I second the motion.

The President : I would like to see the Executive Committee tied up as to the time when they must decide, so that there will be no possibility of leaving it till the last month. The date should be published months before.

Mr. Wyse : The constitution provides that the date should be approximately fixed now.

Mr. Wright : I think "approximately" would mean as near after the prorogation of the House as possible. I think that was understood.

The President : That is a question. It might be desirable to wait and have it later.

Mr. Wright : It would not be earlier than the end of June, that is the usual time we should have the convention, and it should not extend later than the middle of July. The present time is a most inopportune time to hold a convention in my opinion, but, of course, force of circumstances compelled us ; but any time up to about the middle of July would be a suitable time.

The President : There is nothing in the constitution about the approximate date.

Mr. Street : Article 19 gives it.

The President : The only motion before the chair is that by Mr. Wright, seconded by Mr. Kammerer, that the fixing of the date be left to the Executive Committee. (Carried.) If there is any general business we might go on with that.

Mr. Yule : I would like to put before the meeting this resolution :

"Resolved that the hearty thanks of the Canadian Electrical Association be extended to the Mayor, corporation, and citizens of Kingston, the president of the Board of Trade, Kingston, the Kingston Street Railway Co , the Kingston Electric Light Co., the local committee, composed of Messrs. F. W. Simmons, Breck and Nickle, and the warden and officials of the Kingston penitentiary, for the hospitable and courteous treatment accorded to the members of the Association, and to the gentlemen of the press for their full and correct reports."

Mr. Yule : I think I am voicing the sentiments of the members when I say that Kingston is an ideal place for a meeting of this kind. They have the facilities, and they apparently have the heart to entain, and they have done it most excellently. I do not know that we have ever visited a place in which we have received more general recognition and more kind and courteous treatment. I have much pleasure in moving the resolution.

Mr. Kammerer : I have much pleasure in seconding the motion.

The President : I presume the motion is carried. The election results in a tie. I may say that Messrs. Simmons, Browne, Camp and Yule are elected. There is a tie between Mr. Leyden and Mr. Slade. You will kindly vote again on Mr. Leyden and Mr. Slade.

Mr. Kammerer : While the ballot is being prepared for this I would ask that you request Mr. Yule to retire for a few moments.

The President : Mr. Yule, will you kindly retire ?

Mr. Yule having retired, it was moved by Mr. W. H. Browne, Montreal, seconded by Mr. J.J. Wright, Toronto, and resolved, that more than a year having elapsed since the inauguration of the legislation procured by the Legislative Committee for this association under the guidance and leadership of our past president, Mr. John Yule, this Association, recognizing the great advantage and element of justice that has been brought to the operating companies of Ontario by this legislation, feel it incumbent upon the Association as such to record in its minutes the hearty appreciation which it entertains for the original and continued work of Mr. Yule on behalf of such legislation, and that a copy of this resolution properly engrossed be prepared and sent to Mr. Yule, with the hearty compliments of this Association, at an early a date as possible.

On Mr. Yule's return the president put the motion, which, on a vote having been taken, was declared carried unanimously amid applause.

Mr. Yule : It gives me very great pleasure to hear your expressions so clearly set forth in your resolution. I give you my hearty thanks for keeping in mind the work that has been done by the Legislation Committee. You all know what has been done. Some three years ago we were attacked in Guelph by an attempt to pass a by-law to practically wipe us out. The by-law was defeated. I may say to my mind then it was the greatest injustice to an enterprise of a very problematical character. No one knew they would ever receive a return on the investment when they took the chance, and then as soon as the corporation came to think that you were receiving a dividend on your investment, they wanted to practically confiscate the property. I didn't go into this matter entirely for the sake of the companies in Ontario. I had principally in view my own company in Guelph, and there is no one more pleased than I am that we were as successful as we were, and I was very happy to support the Ligislative Committee. The companies responded not only cordially and handsomely with funds, but they came down to Toronto when called on for assistance, and rendered very efficient aid. We have not only succeeded in getting the legislation, but we succeeded in convincing the members of the Legislative Committee that our position is right, and they were doing us no more than justice ; during the last session they confirmed that position by giving us a further trial to work out the Conmee Bill. Three companies during the last two or three months have received the benefits of that bill to the extent of hundreds of thousands of dollars, and there are more to come. If I were to give a word of warning to the companies throughout the province, I would say they had better not be too aggressive in their dealings with corporations. Meet the corporations as soon as any advance is made, and fairly and squarely deal with them as they would deal with any other item of business. It appears to me this movement is going to grow ; it will grow for a time, and then I think it will die out after they have had a little experience. I noticed an item in the Kingston paper referring to one place where they have had a municipal plant for a number of years with which they were going to make money and do wonders, and when they got in their last tax bill they found about three or four mills over and above paying for their light to help to pay for the electric plant and maintenance, and the way they did was they passed a by-law to raise funds to put in their plant, and they seemed to be under the impression that that was the end of the matter. They don't realize that the life of an electric plant is anywhere from six to twelve years ; these debentures probably run for twenty years instead of ten years, and they had to pass another batch of debentures to rebuild and reconstruct, and possibly extend, and before the 20 years are up, if I am not mistaken in my judgment, they will have three lots of debentures going. Companies do not have that advantage, they have to pay as they go ; they have to provide for depreciation, for extensions, and they have to provide to put in modern improvements as electrical machinery is developed. I thank you heartily for your kind recognition of my assistance to the electrical companies of Ontario.

Mr. J. J. Wright : In the meantime, while the meeting is waiting for the result of the ballot, I would like to move, seconded by Mr. Reesor, that it be resolved that the hearty appreciation and thanks of this Association be extended to the gentlemen who have prepared the papers presented at the meetings of this convention ; and that the secretary forward a copy of this resolution to the parties indicated. Carried.

The President : I have to announce that Mr. Edward Slade is elected. Therefore the Executive Committee is as follows : Messrs. A. B. Smith, O. Higman, D. R. Street, J. J. Wright, B. F. Reesor, F. W. Simmons, W.H. Browne, J.W. Camp, John Yule, and Edward Slade.

The President : As there seems to be no business before the chair, I want to take up your attention for a minute or two to tell you how extremely gratifying it has been to me to see such a large attendance at this particular convention. You are aware of what the circumstances were and how difficult it was, and how improbable it was, that the attendance would be large. At least, that was my impression ; and it has been a very agreeable surprise to find that notwithstanding all these things, we have had a fair assembly and a successful convention. The papers have been good, and altogether I think that we cannot feel that we have lost so very much by postponing the convention to so late a date as we did. I came here with the determination to step out of office. I was exceedingly thankful for the confidence that had been reposed in me, and I was quite satisfied to put in the year, and then make room for someone else. It was only through the earnest solicitation, I may say, of friends that I consented to be re-elected. I rather think as a general rule, it is better for an Association of this kind to change its officers a little oftener than two years. To those who are entitled to the positions, and care to take them, it is rather a long time to wait two years between each election, and I don't approve of two year terms as a general rule ; and that was one reason why I did not wish re-election, but so many things were said to make it desirable that I should accept this year that I finally consented to do so, and the convention being in Ottawa next year, was a special inducement. I will endeavor, during the year, to look after your inerests and to organize a convention in Ottawa which shall be as successful as any which has been held heretofore. I trust I may receive the assistance of each and every one of you if I should have to call on you. (Applause.)

Mr. W. H. Browne : Brethren, there being no further business before this convention, and in view of the fact that the grand hospitality of this city has robbed a great many of us of our ordinary amount of repose, I rise to suggest and move a motion of adjournment of this convention until our meeting at Ottawa next year.

Mr. J. J. Wright : I second the motion.

On a vote having been taken the motion was declared carried, and the convention adjourned at 11.45 a.m., to meet in Ottawa in 1901.

THE USE OF THE DYNAMO AND STORAGE BATTERY IN TELEGRAPH OFFICES.

By W. J. Camp, Superintendent C. P. R. Telegraphs.

Previous to 1870, acid batteries of various kinds were used for main telegraph circuits, and the Daniel form of blue-stone battery for the locals, or sounder circuits. Between 1870 and 1874, what is known as the "gravity battery" was brought into general use. This battery is a modification of the Daniel cell, but the sulphate of zinc and sulphate of copper solutions are kept separate by the difference in their specific gravity instead of by means of a porous cup. This form of battery is very constant and requires but little attention as compared with the acid. To obtain the best results not more than two or three wires should be worked from each bank, although frequently ten or more are thrown on one bank of battery. When this is the case the results are unsatisfactory, particularly during wet weather, and when wires of different lengths are combined together. A separate bank is required for each duplex or quadruplex set, and also a local battery for each sounder circuit. It is true that, as each cell gives out about one volt E.M.F., the exact power required for each multiple circuit or local can be very accurately adjusted by adding to, or taking off from the number of cells; and on this account, a great many chief operators raised objections to dynamo currents. However, even this advantage has been compensated for.

While the change from acid to gravity batteries effected a great economy in maintenance, and improvement in the working of the telegraph wires, a much greater stride has been made by the introduction of the dynamo and storage battery in telegraphic work. I will deal first with main lines, and then with local, or sounder and transmitter circuits.

About 1880 dynamos were introduced by the Western Union Telegraph Co. at New York for supplying current to the single working wires. The means for doing this are comparatively simple. Two dynamos are used, each of a voltage high enough for the longest wires; the positive pole of one and the negative pole of the other dynamo are earthed, and the opposite poles connected to two buss wires. The various single working wires are connected to these buss wires, according to the polarity required, through an artificial resistance for each wire. The Western Union in the United States, and both companies in Canada use incandescent electric lamps for these resistances. The Postal Co. in the United States uses German silver wire wound on tin tubes, so designed that, should any heating take place, it is counteracted by a current of cold air which passes through the tube. Additional resistances were inserted on the shorter wires to make all lines approximately of the same electrical length. These resistances were usually of fine German silver wire wound on the handle of a wedge which was inserted with the instrument wedge in the spring-jack of the switch. It has been found much more satisfactory, however, to have several dynamos giving different voltages, and the use of the resistance wedges abandoned.

The next step was to apply dynamo power to duplex wires. For many years back the polar duplex has been used all over America. When using the gravity battery the transmitter (pole changer) was arranged to reverse the poles of a bank of battery from earth to line and vice-versa. This pole-changer required very accurate adjustment in order to reduce the time of reversals to a minimum; the least break in the circuit, or short-circuiting of the battery, being liable to affect the signals at either or both terminals of the line.

For dynamo power the earth connection is omitted in the pole-changer; the armature is connected to the line circuit, the front contact to the negative buss wire, the back contact to the positive, and resistances of 600 or more ohms inserted ahead of each buss wire to prevent arcing at the contacts of the pole-changer.

Then came the application of the system to quadruplex circuits. Great difficulties had to be overcome to effect this. Two entirely different systems are in general use, one by the Western Union and Great North Western Telegraph companies and the other by the Postal Telegraph Co. The Canadian Pacific Co. uses the W. U. system at Toronto and Montreal and the Postal system at other points.

A few general remarks with reference to the duplex and quadruplex as worked with gravity batteries may be of interest at this point to those who have not read up the subject.

Duplex is a system by which two operators can transmit simultaneously in opposite directions. This is attained by winding the receiving relays with two coils of wire in opposite directions, one winding being connected to the line, and the other to a set of resistance coils and condensers which are so adjusted that the electrical length and static capacity are the same as the real line. The home power divides equally, half passing around the core in one direction to the real line, and half in the opposite direction to the artificial line; the result being that the core is not magnetized by it, and is not susceptible to any change in the home power. As the power coming over the line from the distant station only passes through one of the coils, and there is none coming in from the artificial line to counteract it, the core is affected by any change in power at the distant station. The receiver is a polarized relay whose armature closes the sounder when moved in one direction, and opens it when moved in the other. The transmitter is an instrument worked by an ordinary telegraph key and local circuit. It is so arranged that, when the key is depressed the negative pole is connected to the line, and positive when the key is opened.

Quadruplex is a system by which two operators can transmit one way simultaneously with two operators transmitting in the opposite direction, i. e., four messages can be sent simultaneously on one wire, two in each direction. The arrangement by which two operators transmit in the same direction may be briefly described thus:

A transmits by reversing the polarity to line the same as in duplex, and C receives by means of a polarized relay. B transmits by increasing and decreasing the same power which A is reversing; D receives from him by means of a neutral relay which responds to power of any direction if it is strong enough. The retractile spring of the armature is adjusted so that the weaker power does not move the armature, but when the full power is on the spring is overcome. By double winding both receivers at each end as explained for the duplex, we obtain "two circuits in the opposite direction."

In order to obtain satisfactory work all resistances must be maintained at their relative length. When using gravity battery transmitter "B" simply adds more cells to "A's" battery, or takes them off when closing or opening his key. A resistance coil to compensate for the internal resistance of the extra battery is automatically cut out, or inserted, thus maintaining the total electrical length of the line from earth to earth.

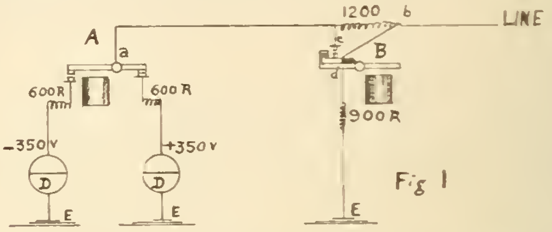


Fig 1

The W. U. system of transmission is shown in Fig. 1. The resistance from A to earth through the dynamo circuits is 600 ohms no matter which position transmitter A is in. When transmitter B is closed the resistance from b to earth is 600 ohms because the 1200 ohm coil is shunted out by contacts c and the leak of 900 ohms is disconnected at d. The full power of either the negative or positive dynamo goes to line through one of the internal resistances of 600 ohms. When the transmitter B is opened the 1200 ohm coil is inserted between b and c making the total resistance between b and earth via the dynamo of 1800 ohms. There is also another route to earth, through the leak of 900 ohms. The joint resistance of these two routes is 600 ohms, as found by the formula $\frac{A \times B}{A + B}$ or $\frac{(1200 + 600) \times 900}{(1200 + 600 + 900)} = 600$ thus maintaining the same resistance between b and earth for all changes.

The amount of power passing b to line is however reduced to $\frac{1}{3}$ when transmitter B is open, first, on account of the added resistance of 1200 ohms, and second, on account of the leak of 900 ohms. In other words when transmitter B is closed the power passing to line is three times as much as when B is open.

By changing the added resistance to 1800 and the leak to 800 ohms the difference is then as 4 to 1 and the internal resistance still maintained at 600 ohms.

The principle of the Postal system of quadruplex transmission is shown in Fig. 2. For the purpose of explanation, transmitter A is shown as two separate instruments worked simultaneously by one key. The one on the left gives 350 volts to the line and the one on the right 100 volts. Opening of the key connects either m or p to line according to the position of transmitter B; closing of key connects either n or o; or opening A gives positive pole and closing gives negative. Closing transmitter B connects line through b, c, a, to dynamos m or n (350 volts) according to the position of transmitter A; opening transmitter B connects line through b, d, e, with dynamos o or p (100 volts). Thus B transmits by increasing or decreasing the power sent out by A. As the resistances in each of the four leads to the dynamos are the same (600 to 1000 ohms) the internal resistance from b to earth is constant.

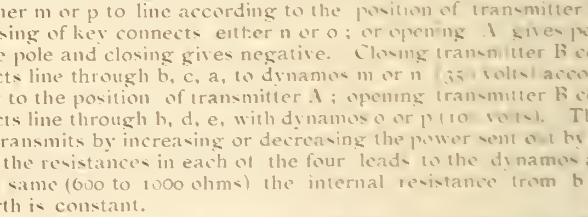


Fig 2

It is hardly within the scope of this paper to compare one system with the other. It is sufficient to state that either system has certain advantages and both give excellent results. The receiving instruments are the same as for gravity battery.

The dynamos are made of sufficient voltage for the longest quadruplex circuit from the office. When the same machines are used on comparatively short circuits a resistance coil of 1000, or more, ohms is inserted between b and the receivers.

We now come to the locals. For ordinary sounder circuits a very simple plan is to use a dynamo of 6 volts and connect all sounders in multiple. The sounders are wound to 20 ohms resistance; but in nearly every office where dynamos are used there are also quadruplex or duplex sets, and it is often necessary to connect these as repeaters. There are a number of systems, but I will only describe the one in use by the C. P. R. This is, I think, the most simple yet designed. It is shown in Fig. 3. Each half quadruplex or half repeater is treated as a duplex set. All sounders and transmitters are wound to 20 ohms and, by resistance coils, each local circuit is brought up to 100 ohms. The dynamo gives from 20 to 25 volts. The former is found to be sufficient. The figure shows the instruments in a normal position, except that the transmitter wedge should be inserted in the spring jack. Starting from the dynamo the receiving circuit passes through the relay contacts, 20 ohm sounder, 80 ohm coil, earth to dynamo, the leg through jack being open at c. The sending circuit is from dynamo through switch b, key, 20 ohm transmitter, switch a, d, wedge, back contact of jack, 80 ohm coil, earth to dynamo.

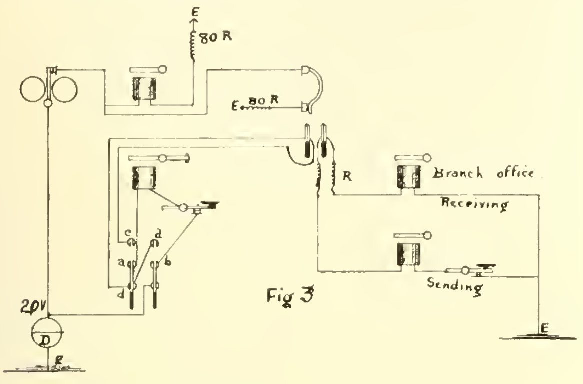


Fig 3

To work as repeaters the wedges of the two sets are exchanged, that of No. 1 set, being inserted in No. 2 jack and No. 2 wedge in No. 1 jack ; the table switches a and b on each set are reversed.

The circuit then is, earth, dynamo, relay contacts, 20 ohm sounder, 80 ohm coil, earth ; also from relay contact to top of jack, front of wedge of No. 2 set, c, a, transmitter, key, b, d, back of wedge, coil and earth. The circuits from No. 2 set are the same. Any break in contacts of relay opens its sounder and also the transmitter of the other set. Thus signals received from the line on No. 1 set are automatically retransmitted over the line connected to No. 2 set, and vice versa.

To extend the locals of a duplex to a branch office, the loop wedge is inserted in the spring jack on top of the transmitter wedge ; switch a is turned up ; switch b down. Circuits are then as follows : Receiving side, dynamo, relay, sounder, coil, earth ; with leg from relay contacts to top of jack, front of wedge, coil, line, branch receiver and earth. The resistance coil is adjusted so as to make the circuit from wedge to branch earth total 100 ohms including branch sounder.

Sending side, dynamo, b, key, transmitter, a, c, front of transmitter wedge, back of loop wedge, coil, line, branch sounder, key and earth. The resistance from wedge to distant earth is 80 ohms including sounder. On this circuit the resistance of the transmitter is added making a total of 100 ohms.

Sometimes the dynamos are operated from a common shaft driven by an electric motor or other power, but the plan most generally adopted is to use motor generators, each machine working independently. In order to be reasonably certain of a continuous supply of power, spare leads are run to different power stations, and spare machines are also kept in readiness, so that not more than a minute or so is lost at any time.

In cities where continuous power cannot be obtained from at least two different stations, storage batteries are now largely used. Generally speaking, the wiring of a telegraph office, from the discharge leads of a storage battery to the instruments, etc., is the same as for dynamos, but extra switches have to be used for connecting the various banks of battery with the charging or discharging circuits. Various devices are used, but as I consider the C.P.R. system the most flexible, I will describe it only.

At Vancouver the Winnipeg street railway power is transformed by two motor generators ; one reducing the power to seven volts of twenty amperes capacity for charging local batteries ; and the other to 130 volts, 5 amperes, for main batteries. In Ottawa a 250 volt power is reduced to seven volts for the locals and the mains are charged direct without reduction. In St. John the 114 volt lighting circuit is used. The locals are in two banks, of two cells each, of chloride accumulator, type E 9, one bank being charged while the other is discharging. There is no dead resistance inserted in the local circuits, as is the case where dynamos are used, extra cells providing the necessary power when quadruplexes or duplexes are extended to branch offices.

The switch for the main batteries consists of a series of spring-jacks and wedges, so designed that the jack is open, and a wedge cannot be inserted when reversed. The cells (which are C3 type of accumulator) are arranged in banks of 40 or more as needed to meet the requirements of the office, and of a voltage sufficiently below the charging circuit. The negative pole is connected to the top of a wedge and positive to bottom. The wedges are all interchangeable. As many banks as required can be charged simultaneously.

In Canada, the C. P. R. has storage battery plants at Vancouver, Winnipeg, Ottawa and St. John, and dynamos at Toronto. The new Telegraph building in Montreal will also be equipped with dynamos. At present power in the latter place is obtained from the dynamo plant of the G. N. W. Tel. Co. I understand that the W. U. and G. N. W. Co's have storage plants at St. John, Quebec, London and Ottawa, and dynamos at Toronto and Montreal.

The adoption of either dynamos or storage battery for power on telegraph lines has very materially improved the working of the lines, and at the same time effects a great economy. One or the other will gradually replace gravity batteries for all main lines, and the time may come when even the locals at wayside stations will be worked by storage battery cells which will be charged at some central point and sent out by train.

CONDITIONS AFFECTING THE WAVE FORM OF ALTERNATORS.

By L. A. Herdt and E. M. Archibald.

In what is given below it is not intended to consider the question of wave form as affecting successful distribution, but rathor the extent to which the e.m.f. wave of certain machines may change under not unusual commercial conditions.

In alternator specification, along with regulation, heating and other clauses, it is often argued that a clause relating to wave form should be included, but as comparatively little is known of the extent to which the wave forms of modern alternators change with amount and character of load—to say nothing of the effect of such changes on the operation of the receiving machinery—it seems advisable that more information be accumulated before very rigid wave form requirements are inserted. However, with a view of throwing more light on the subject, a series of experiments were undertaken in the electrical engineering laboratories of McGill University during the past winter and though not complete, certain results already obtained may be of interest.

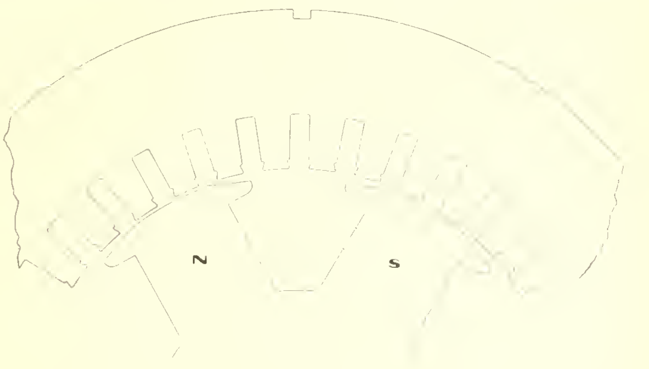


PLATE I.

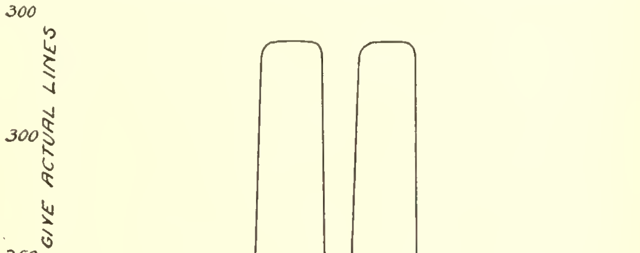


PLATE I

FIG. 2.

For the purpose in hand a number of different types of alternators were available, some with a concentrated armature winding, and some with distributed windings of the revolving arma ture, revolving field and inductor types. The e.m.f. waves were obtained from each at different field excitations, different armature currents and different power factors, lagging and leading. The distribution of induction in the air gaps under different conditions was also obtained by means of small test coils suitably placed. As illustrating the general effect of lagging and leading armature currents in relation to type of machine upon induction distribution and consequent wave form, the results obtained upon a revolving field distributed winding alternator, part of the magnetic circuit of which is shown in Fig. 1, Plate 1, and upon an inductor type machine with a concentrated winding and poorly shaped inductor lug, shown in Plate II, may be cited.

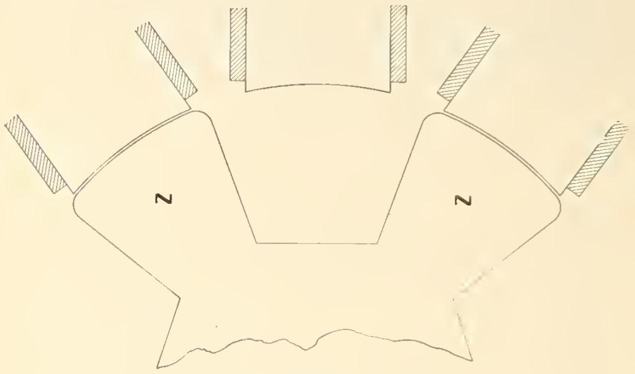


PLATE 2.

In Fig. 2, Plate I, is seen the distribution of induction in the air gap of the first machine for the particular position of the field pole shown. As might have been expected, the larger part of the induction enters the armature through the teeth, but about one-third, in the case of those teeth immediately opposite the pole, passes into the armature by way of the slot due to the practical saturation of these teeth. The no load e.m.f. wave of each coil of the distributed winding may be constructed from the no load induction distribution curve by the method of tangents and for any group of coils by taking the algebraic sum of the instantaneous e.m.fs. of the individual coils. This has been done and the results found to check quite well with experimental values.

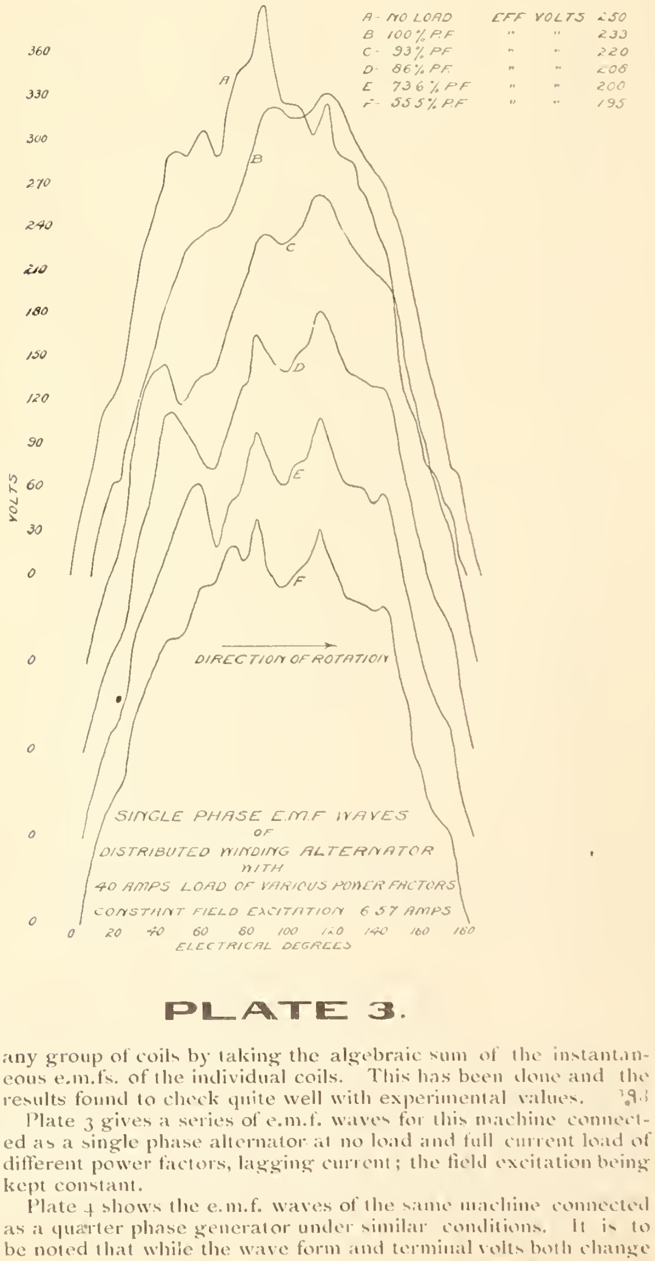


PLATE 3.

Plate 3 gives a series of e.m.f. waves for this machine connected as a single phase alternator at no load and full current load of different power factors, lagging current; the field excitation being kept constant.

Plate 4 shows the e.m.f. waves of the same machine connected as a quarter phase generator under similar conditions. It is to be noted that while the wave form and terminal volts both change a marked degree with power factor, the change is not nearly so great as in the case of the second machine having a concentrated winding and comparatively weak field.

With a concentrated winding the conditions are different, the wave form not being a function of the angular displacement of the armature coils.

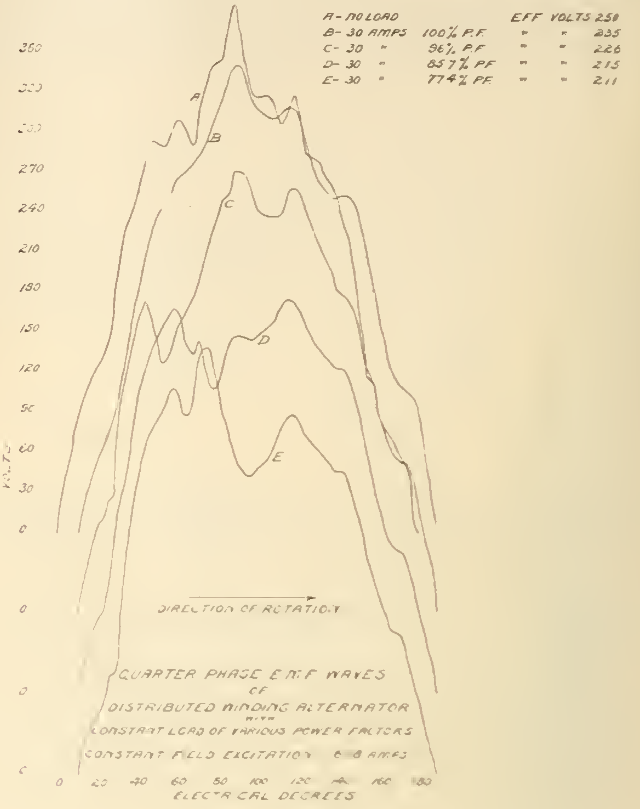


PLATE 4.

In Plate 5 is given the no load induction distribution in machine

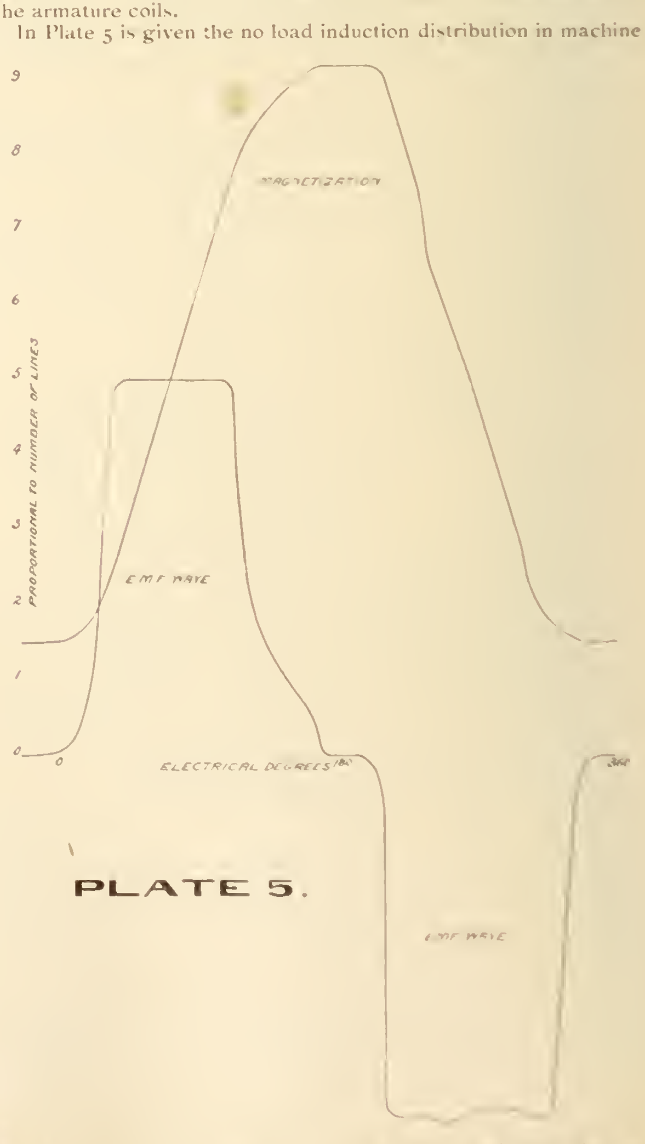
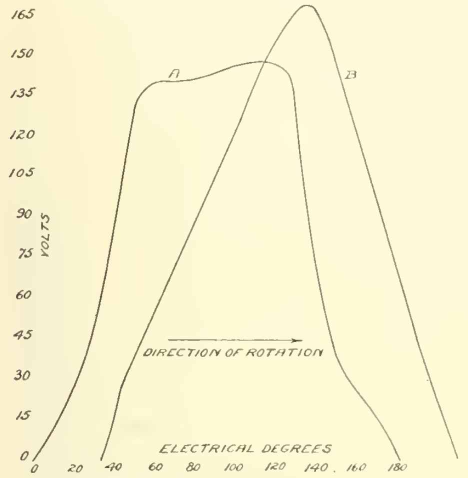


PLATE 5.

No. 2 at normal field excitation. It is to be noted that, due to poor design, the armature induction at minimum points is a considerable fraction of its minimum value, which would not be the case in rightly proportioned machines of this type. With this machine also the no load wave form was readily predetermined from the curve of induction distribution and found to agree with the experimental values.

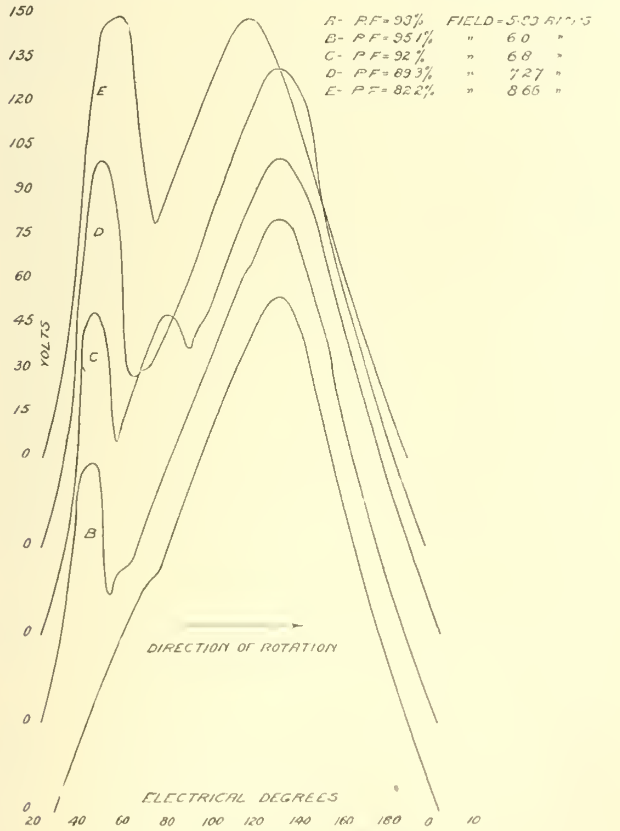
In Plate 6 is shown the no load and load E.M.F. waves at different power factors. The change of wave form with character of load is, to say the least, startling, especially to those who have been accustomed to regard the sine wave assumption as to alternating E.M.F's. sufficiently near for practical purposes. The effect upon the operation of synchronous and induction machinery designed for sinusoidal E.M.Fs. of such waves as shown can be pretty well anticipated. Several synchronous motors were in turn operated from a generator whose wave form was made to vary by changing the character of an auxiliary load. In every case, as might be expected, the energy absorbed and the idle current to the motor increased with dissimilarity of wave. Also the tendency to fall out of step with slight provocation was very marked when the wave shapes were greatly different, but as above indicated, such experiments are not yet complete. It is hoped, however, that enough has been said to induce a discussion of this certainly important subject, particularly from the standpoint of the purchaser and operator of alternating current apparatus.



SINGLE PHASE EMF WAVES
OF
CONCENTRATED WINDING INDUCTOR ALTERNATOR
FROM ONE COIL ONLY

A - NO LOAD. EFF VOLTS 220 FIELD CURRENT 3 AMPS
B - 70 AMPS NON-IND LOAD. EFF VOLTS 220. FIELD CURRENT 6 AMPS

PLATE 6.



SINGLE PHASE E M F WAVES
OF
CONCENTRATED WINDING INDUCTOR ALTERNATOR
WITH
60 AMPS LAGGING CURRENT AT VARIOUS POWER FACTORS
FROM ONE COIL ONLY
TO OBTAIN GENERATOR VOLTAGE MULTIPLY BY 2
EFF E M F CONSTANT AT 220 VOLTS

PLATE 7.

We desire to acknowledge our indebtedness to Prof. R. B. Owens for the suggestion of the work carried out and for valuable assistance.

POWER FACTOR AS AFFECTING OPERATION AND INVESTMENT, WITH SPECIAL REFERENCE TO INDUCTION MOTORS AND ENCLOSED ARC LAMPS.

By F. H. Leonard, Jr.

Power factor is the ratio of the true watts, to the apparent volt amperes in an alternating current conductor, circuit or device (Houston). In a direct current circuit the energy is calculated by multiplying the volts by the amperes, and the result is the true energy in the circuit in watts, but in alternating current circuits this does not follow, as the electromotive force wave is out of phase with the current wave in every case except when the load is purely non-inductive, as with a load consisting of incandescent lamps only. When arc lamps or induction motors are used, there is always a lagging phase displacement of the current, and when synchronous motors are used, there is also a phase displacement of the current which may be either leading or lagging behind the electromotive force wave, and both conditions may occur, in the case of the generator being driven by a steam engine, twice in each revolution.

With water power, a steam turbine or other prime mover where the angular velocity can be maintained practically uniform and where speed variations affecting the generator take place gradually in a period covering several revolutions of the generator, much better results can be obtained with synchronous motors, always of course presuming that the motor is designed to, and does in practice, give the same electromotive force wave as that produced in the generator, which for reasons which have been at length discussed by many able authors should be a sine curve.

Power factor is comparatively a new term to the central station manager, and in fact, was hardly ever heard of before the introduction of the A.C. motor, though some central station superintendents had noticed that there was considerable current flowing in their primary circuits when all their transformers were running with open secondary circuit, and that this current did not take the energy from the steam engines corresponding with the volt ampere readings. To express this condition the terms false currents or wattless currents were used.

The transformer when very lightly loaded or when running with open secondary takes much more apparent energy from the circuit than the real energy, because of the lag or phase displacement of the current wave. This displacement, however, grows constantly less as the load is increased, until the E.M.F. and current waves nearly coincide. To illustrate this graphically, the two diagrams of E.M.F. and current waves in a transformer in open circuit and under full load show that the instantaneous values of the product of volts and amperes must be less than the apparent watts, and must be multiplied by the power factor to represent the true energy. As will be noted, the maximum E.M.F. occurs before the current has reached its maximum point.

Referring to the full load curve it will be seen that current and E.M.F. curves have nearly reached conditions where they increase and decrease together. The nearer this condition is approached, the nearer the power factor approaches unity or 100% power factor. As an induction motor is practically the same as a transformer with one of its elements in motion, its action with regard to power factor may be traced in the same manner, as explained in connection with a transformer.

The primary circuit furnishing the magnetizing current or field and also the work current by induction to the secondary, which when running light generates a counter E.M.F. so high that only enough current is taken in the secondary to overcome the friction of the bearings. As load is added the speed is slightly reduced, the slip resulting in lowering the counter E.M.F. until enough current is allowed to flow to do the added work. A very slight reduction in speed is sufficient to reduce the counter E.M.F. of the secondary of the motor varying not to exceed 5% in speed from light to full load and usually not over 2%, over the working range of load usually met with.

These motors are self starting from the A.C. lines, and with suitable starting devices take about full load current for a few seconds in coming up to speed light, or a little more than full current in bringing up to speed their normal load, a somewhat longer time being occupied in reaching full speed, depending on the inertia and friction characteristics of the work.

If you will consider the counter E.M.F. of the motor secondary as the equivalent of resistance of the transformer secondary the similarity of action will be more striking.

The synchronous motor differs from the induction motor from the fact that it does not make its own field, which is usually excited from a separate source of direct current, and it is not usually capable of starting itself even without load, but must be brought up to synchronous speed by means outside of itself. A small induction motor is generally supplied for the purpose, which is disconnected after the synchronous motor has been brought up to speed.

The load is then applied gradually with a friction clutch coupling, friction pulley or equivalent device. Once in step, the synchronous motor cannot vary in speed, except the generator driving it changes speed, any more than though the two were positively coupled or mechanically geared together, except by overload much beyond the capacity of the motor, which breaks it out of step as though the gear were broken, and having fallen below speed even for a fraction of a second, it cannot recover, but will stall, in the meantime absorbing excessive current unless the circuit is immediately opened. The load must then be thrown off and the motor started again as at first.

The fact that the synchronous motor has a separately excited field is an advantage under certain conditions as pointed out in my paper before the National Electric Light Association at the New York meeting in '95. By increasing the field excitation sufficiently in a synchronous motor the apparent paradox of a counter E.M.F. higher than the line of impressed E.M.F. is produced by the motor sufficient to raise the E.M.

F. of the line, overcoming all drop, and even altering the pressure at the generator itself, at the same time introducing leading currents having a condenser effect on the line which may be made to balance out the lagging currents produced by induction motors, arc lamps, &c. If this leading phase displacement can be made equal to the lagging phase displacement of other devices, a power factor of unity would result, as suggested by an eminent engineer, though in practice, during a period covering the whole history of this branch of the art, I have never met such a condition, nor have any of my friends in the profession, many of whom have had extensive experience with synchronous and induction motors separately and both together on the same circuits.

An over-excited synchronous motor in the right place, with a load not subject to sudden variations and in charge of an attendant in communication with and controlled by the central station chief, is a convenient means of overcoming line drop and poor power factor. Over-excitation should not be carried too far, as it will result in pumping or flickering the lights. I have a vivid recollection of a case in which a 2½ h.p. self-starting synchronous motor, which I designed, pumped the whole circuit on a 300 k.w. alternator.

Under a steady load and careful adjustment of the field excitation, a large synchronous motor supplied with current from a well-designed generator driven by water power or steam turbine, a power factor at full load of .94 or a fraction better may be obtained, though the same motor furnished with current from the same generator driven by a slow speed reciprocating engine, would hardly attain a power factor of .90 at full load, as the fly wheel moment of the motor would make it difficult to follow the changes in angular velocity of the generator, the tendency to break out of step resulting in surges of current, as before intimated.

Generators directly connected to slow speed reciprocating engines, in my opinion, are not suited for operating synchronous motors or rotary converters unless extreme care is taken in designing the fly wheel so as to obtain the minimum change of angular velocity per revolution. A much larger percentage of speed variation taking place more gradually, is less disastrous to the attainment of high power factor.

The best load for a synchronous motor is one of uniformly steady character with no sudden changes in the work it has to do.

Throwing the load off suddenly calls for instantaneous adjustment of field excitation in order to prevent sudden rise of E. M. F. which in a large motor would affect the whole line, and even change the voltage of the generator, having a disastrous effect on incandescent lamps that may happen to be in circuit. Suddenly adding a load to a synchronous motor has the reverse result and adjustment of the fields become immediately imperative to prevent heavy drop in E. M. F. A single synchronous motor subject to sudden load variations may easily defeat any attempt at good regulation on the part of the central station management.

These objectionable features are minimized, though never wholly overcome by designing both generators and motor for exceptional regulation using a distributed armature winding with a large number of slots per pole, per phase. The old style armature with windings concentrated into a single slot per pole, per phase, are unsuited on account of their high armature reaction for this class of work.

The induction motor being complete in itself, requiring no exciter starting motor or clutches, and furthermore, being automatic in its regulation without any special appliances, free from commutators or brushes, is simplicity itself, its essential features consisting of a stationary primary and a rotating secondary in large sizes when well designed, has a power factor at full load of .94 or better, regulates well under sudden fluctuations of load without reflecting seriously on the line and generator, but in fact actually tending to assist the regulation of the line. A load thrown suddenly onto an induction motor immediately increases its power factor and helps the regulation of the generator supplying this sudden demand for current. As the power factor of the induction motor is low at light load, it follows that a sudden reduction of the load at once lowers the power factor of the motor, calling for lagging currents in the line, replacing by inductive drop the ohmic drop of the work current of the moment before the armature reactions in the generator tending to demagnetize its field and prevent increased E.M.F. which would otherwise result when load is thrown off.

For varying loads and for operating incandescent lamps in connection with a power circuit, under the ordinary commercial conditions, the preference is altogether in favor of a well designed induction motor. With a secondary consisting of copper bars secured to short circulating rings at both ends, insulation is never troublesome, and in fact may be omitted entirely. It rotates without electrical contacts or connections inside the stationary primary element which can be safely insulated for all ordinary voltages, and in the larger sizes connecting the two thousand volts pressure directly to the motor terminals. In the small sizes it is of course advisable to use transformers to reduce the pressure to 500 volts or less where subject to careless handling. Having once become familiar with them, you would never think of using direct current motors with their troublesome commutators and brushes and expensive repair accounts.

Intelligent selection of the size of an induction motor for the work it has to do, has a very important influence on the power factor of the line and should not run with an average load much below its rated capacity. It is much better to select the motor which, being loaded to its rated capacity, or nearly so, operates with a high power factor and can be overloaded for short intervals to the extent of 25% of its capacity without doing any harm, as there are no delicate parts to this type of machine, nor any moving insulated wires, they will stand a much higher temperature without deterioration than the equivalent direct current motor.

Induction motors are also designed for variable speed, many now being used for crane work, and other uses calling for variable speed and torque, but in this class of work they are hardly equal to the direct current series motor, and unless very expensively designed, operate with low efficiency and power factor, though where non-inductive resistance is used for control, the power factor may be improved at the expense of efficiency.

Arc lamps have been until recently operated from direct current series dynamos, though the first important arc lamp installation used in the city of London, England, the Joblacof candles as they were called, were operated by alternating current dynamos.

Several years ago the direct current incandescent companies realized the advantage of being able to supply arc lamps from their incandescent circuits and adopted the D. C. incandescent open arcs. These were soon followed by the enclosed arcs, which operating at a higher voltage admitted of individual control without excessive waste in the large resistance required with the open arcs. Besides this, a great saving was realized in the amount of carbon burned, the inner globes preventing access of oxygen which rapidly disintegrates and causes the carbons to waste away. By no means the least saving which followed was the reduced labor, one man easily trimming six times as many enclosed arcs as he could of the open arcs, as they required attention once in several days instead of daily trimming.

From the D. C. enclosed arc it was but a step to the A. C. enclosed arc with resistance in series, or with Auto-transformers or choke coils on commercial A. C. incandescent circuits.

It was found, however, that the A. C. arcs operated to reduce the power factor of lines with which they were connected, depending on the regulating device used in connection with them, it being practically impossible to obtain a satisfactory light without some regulating arrangement, though sometimes sufficient choking effect is produced by the feed regulating magnets. All such regulating arrangements reduce the power factor, except the resistance method, but the resistance while improving the power factor wastes true energy and reduces the efficiency, while the inductive regulators only increase the apparent energy or wattless currents.

The advantage of operating arc and incandescent lamps from the same dyanmo simplifies the central station equipment and admits of the use of a single type of dynamo for all purposes of higher efficiency, interchangeable parts, one type of reserve apparatus, and easier switch board control.

Some of the best inventive talent on the continent has recently been enployed upon devices to enable the central station management to rid themselves of the D. C. series arc dynamos, which at best occupy much floor space for their output and have a maximum efficiency of 75 to 80% as against an efficiency of 90 to 97% in large modern A. C. dynamos which occupy the minimum floor space per unit of output at much lower first cost.

For A. C. street lighting with lamps in series, one device has followed another till we now have an almost bewildering variety, each device having its superior points, making the choice more difficult.

The constant current transformer operating a string of arcs is almost perfectly automatic provided the load is not too much reduced and can be tapped onto any part of the line to economize wire, the device itself being located in a small substation which may consist of an underground vault, as inspection and adjustment is not frequently necessary. This arrangement has a very fair power factor at full load, but the power factor is low when partly loaded.

A device operating on the choke oil principle has all the advantages named in connection with the first arrangement. The amount of choking effect is regulated by the number of lights which is desired to compensate for. If a small percentage of regulation is required, a small regulator at low first cost is sufficient, and at full load the power factor is high, the inductive effect depending almost entirely upon the lamps themselves.

Another arrangement has been designed on the principle of the constant potential transformer with loops taken out to automatically vary the voltage as lamps are turned off or on. The power factor is good and rather better at light load than the others, but such a regulator should be kept in the central station, or in a substation when it has the advantage of an intelligent attendant.

Besides devices of the above types, individual transformers may be used, but their high first cost and the fact that each lamp must be turned on and off individually instead of in groups as with the previously mentioned apparatus, makes their use impractical for street lighting except under special circumstances.

In some notable cases where central stations are using power transmitted from a distance, induction or synchronous motors have been coupled direct to D. C. arc dynamos; this would be the ideal place to use a synchronous motor immediately under control of the central station if the induction motor load occurred at the same time, but unfortunately they occur at different periods and we can see no reason for using the synchronous motor, as the induction motor is self starting and requires no separate excitation.

In any case the motor driven arc dynamos are out of the question except where the frequency is too low for satisfactory arc lighting. Arc lamps are very unsatisfactory on 25 cycles and their effect at least unpleasant unless the frequency is in excess of 35 or 40 cycles.

With a mixed lighting and motor load there should be no difficulty in getting a line power factor of .90, and with load consisting mainly of motors .80 to .85. I have in mind a case where about 3000 h. p. in motors ranging from fan motors to motors of 500 h. p. are used, and recently measurements showed a power factor of about .90, the percentage of incandescent lamps on the circuit being almost negligible.

A power factor of .80 at full load would be disastrous to the regulation of the old style single phase dynamos; no amount of excitation would enable them to hold the voltage on the line. Though many will no doubt recollect seeing at the World's Fair at Chicago in 1893, the then monster two phase dynamos, which were but two large alternators with armature mechanically coupled together so as to give the proper phase displacement to the two independent circuits.

Some of our Canadian water power stations who have not yet installed polyphase apparatus having two single phase alternators, might adopt this method of obtaining two phase currents to start a power circuit. With ample water power, the added expense for a day circuit would not amount to much, probably little more than the cost of an additional attendant, which would easily be covered by a contract for furnishing power to some manufacturing establishment, or perhaps pumping water for the city and neighboring villages. The power business once started would grow rapidly and become an important source of revenue. Few realize the extent to which the power business is destined to grow.

The old style alternator will stand a moderate amount of motor load mixed with lighting load, but when the motor load becomes a large percentage of the total load, the old dynamos which perhaps were admirably adapted for supplying incandescent lights will no longer be suitable.

The growth of the motor business has called for radical changes in the design of alternators. Machines which on short circuit would give double full load current were the rule, and this was even urged as a distinct advantage in such an emergency.

For motor work, the inherent regulation indicated by a short circuit current of at least three or four times full load current is demanded, and a change of excitation with full load current and .80 p. f. not exceeding 15 or 20%, and capacity for 25% more than normal full load current for six hours without dangerous heating, or 50% more than full load current for one hour, which means a very superior dynamo; this state of perfection having been reached through gradual evolutions resulting from the difficulty of maintaining regulation with motor loads and lagging currents, which tend to demagnetize the fields and lower the voltage.

The lagging currents call for increased capacity in the dynamo line and transformers which supply current to the phase displacing devices, though the power is not increased beyond the small amount necessary to supply the I. R. losses in the copper.

This calls for increased investment to cover the first cost of the improved dynamo transformer and added copper, though notwithstanding the advance in raw materials, the very superior dynamos of to-day cost no more than the dynamos of a few years ago, and not so much per k. w. as we were obliged to pay ten years ago for the old single phase dynamos.

In all classes of business it is poor policy to attempt to save on the first cost of a plant by buying machinery which is out of date. This is particularly the case in making an investment in electrical apparatus, the design of which has been undergoing such active gymnastics in the past ten years. We must look well into the future and anticipate the growth of the power business, which already bids fair to outstrip the lighting, and get only the best apparatus well up to date in every particular. The apparatus made by the leading electrical manufacturers on intelligent specifications more nearly approaches perfection than any other power translating device, notwithstanding the comparative youth of the art. What engine or water wheel builder would for a moment consider a specification calling for 96% efficiency? Yet electrical manufacturers for the larger sizes of dynamos will guarantee even better than such efficiencies.

With these high attainments it is hard to conceive of any material improvement in electrical apparatus, and we shall probably see little more of the changes once so frequent where entire plants were consigned to the scrap heap because it was cheaper to buy new than to continue even for a short time the operation of the old, the difference being sufficient to turn the balance between success or failure of the enterprise.

Already the process of standardization of things electrical has set in, and we may look for changes in the future, tending to a reduction to well recognized standards in construction of apparatus and central station practice rather than to startling improvements in design.

Power factor, which at one time was the great bug-a-boo of the electric central station, is now being rationally met and provided for in the equipment of power houses as a necessary evil and one of the incidental expenses of a new branch of the business, which adds materially to the income of the plant and enables the hard working manager and superintendent to please his stockholders with increased dividends.

SOME EXPERIMENTS WITH ROTARY CONVERTERS.

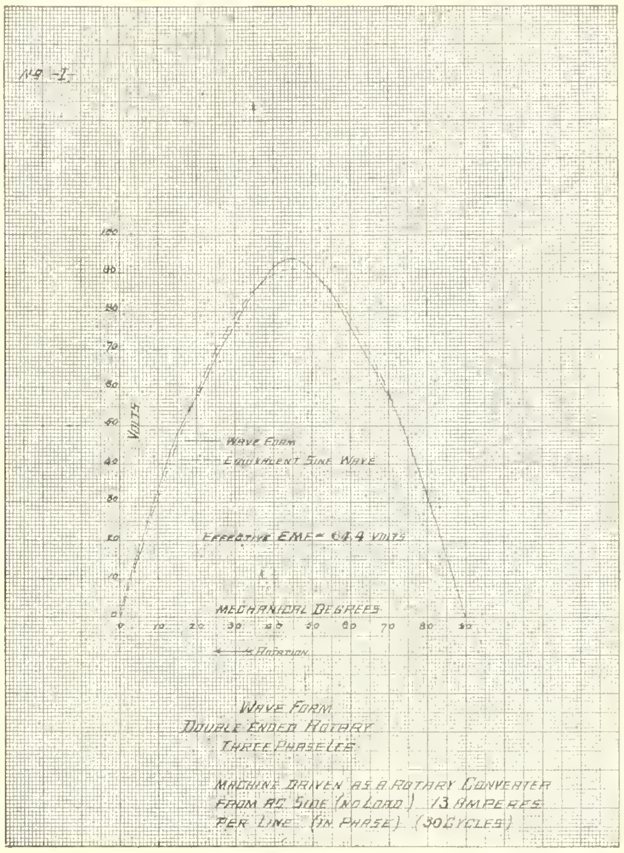
By A. G. Grier, B.Sc., and J. C. Hyde, B.Sc.

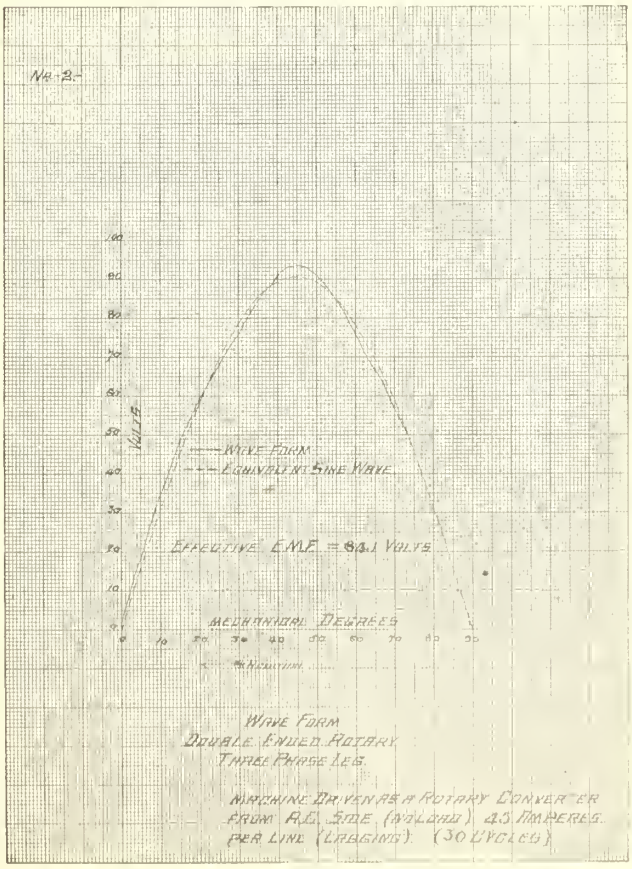
In the last few years Rotary Converters have gradually come to the front and at present are an important factor in some of the most modern and best equipped transforming stations. They form the connecting link between alternating and continous currents in the simplest and most efficient way.

The following experiments were carried out during the past session in the electrical engineering laboratories of McGill University.

WAVE FORMS ON A ROTARY CONVERTER UNDER DIFFERENT CONDITIONS OF LOAD.

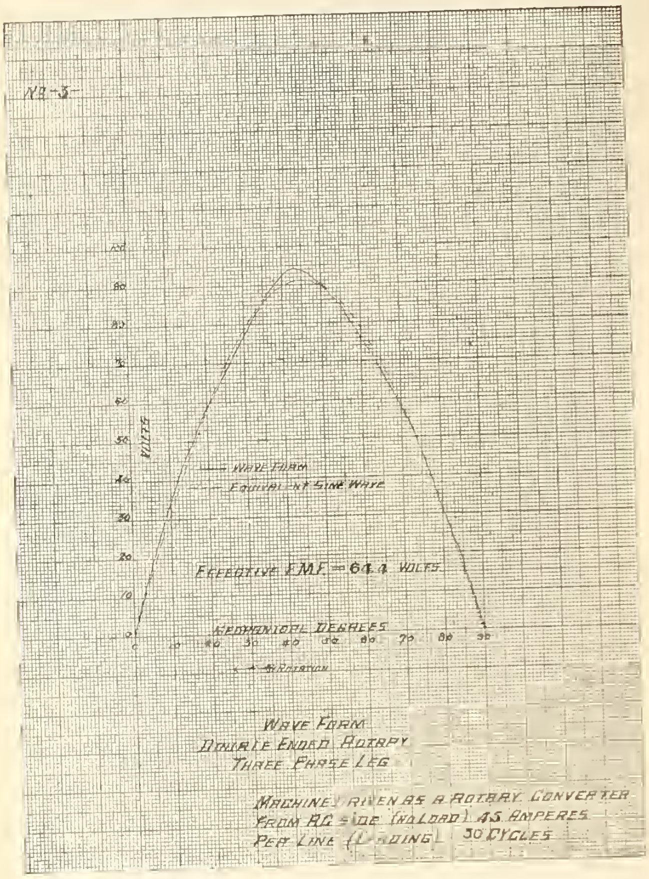
The wave forms shown as per curves were taken under different conditions on two rotaries. They show that armature reactions are very small and the 3 phase wave form approaches very near a sine wave, practically holding it under all conditions of load. The first four wave forms were taken on a double ended rotary, or in other words, one with two separate and exactly similar windings on the one armature body, each winding having its own commutator and collector rings. It was thus possible to run the machine as a rotary converter from one winding and get the induced volts from the other winding. The first curve is for an inphase running light current of 13 amperes, the second curve is for a 45 ampere lagging running light current, and the third a 45 ampere leading running light current and the fourth a 61 ampere inphase load current. From these curves the effect of armature reactions on the wave form is hardly noticeable. Curves Nos. 5, 6 and 7 were taken on the second machine, the greatest distortion of the wave being when the machine was mechanically run as a continuous current generator. In taking the wave forms the voltage to be measured was made to charge a condenser which was then discharged through a Weston volt meter by means of a suitable disc placed on the end of the shaft.

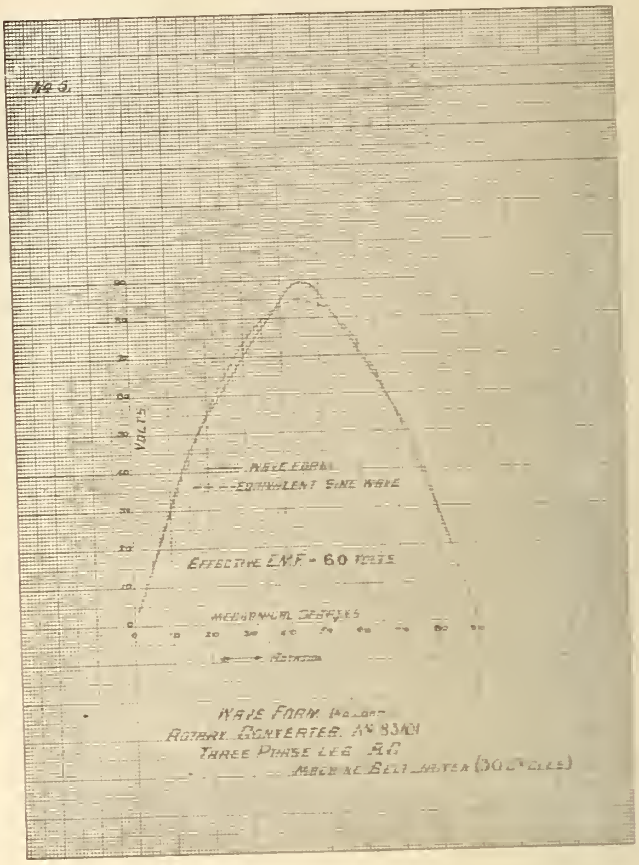


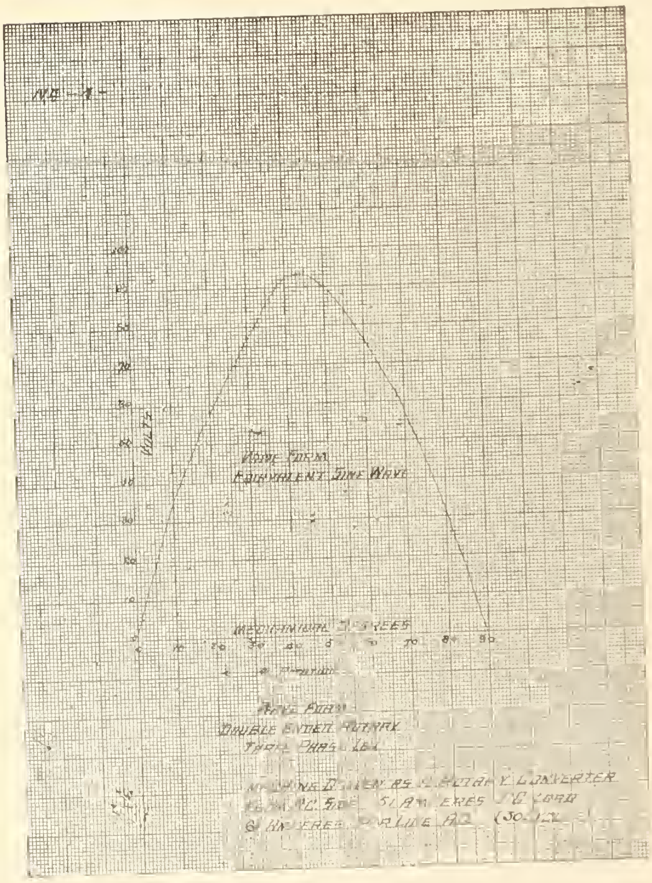


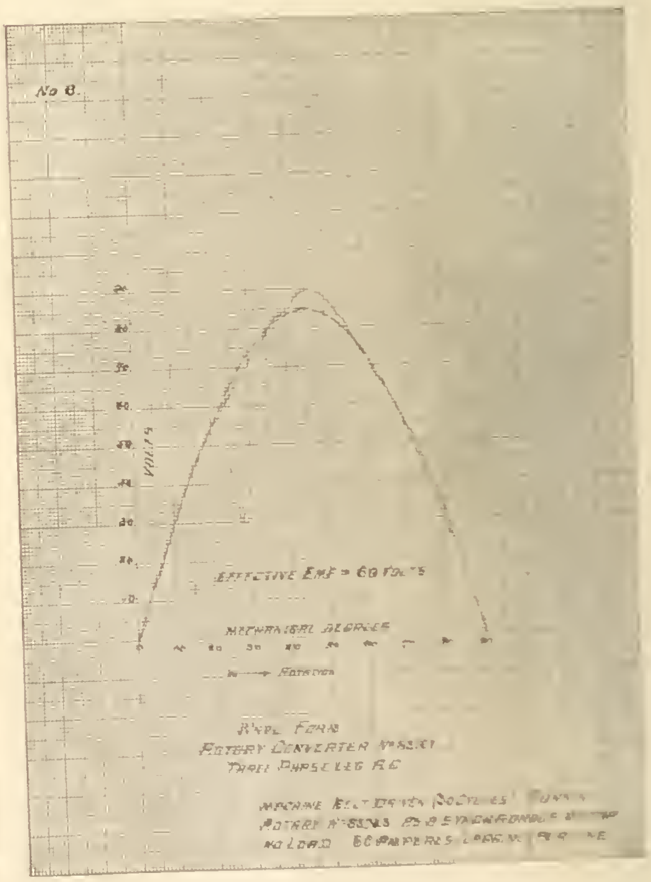
COMPOUNDING A ROTARY CONVERTER BY MEANS OF IMPEDANCE COILS IN THE LINE.

The D. C. voltage of a rotary converter depends on the impressed A. C. voltage, so that as the D. C. load comes on to keep up the D. C. volts some means must be used to raise the impressed A. C. volts. There are two general ways of accomplishing this, viz., by using induction regulators or having impedance coils in the lines which, accompanied with a change in field strength of the rotary, will raise or lower the voltage as required. In some cases where a wide variation is required both ways are used. The action of the reactance coils may be made entirely self-regulating by having compound turns on the rotary. At no load a good lagging current should be used, gradually working up to an inphase current at about three-quarter load and a leading current beyond this. The diagram (No.8) shows an A. C. generator belt driven feeding a rotary converter with compound turns. This machine when run as a D. C. generator was slightly over-compounded. The machines were used as three phasers. The D. C. regulation of the rotary converter at different loads was first taken without reactance coils in the lines, the impressed A. C. E. M. F. being kept constant throughout. After this three similar reactance coils were placed one in each line (machines delta connected) and the regulation again taken. In this case a lag of 68° was started with, ending up with a lag of 12°. The terminal voltage of the generator was kept constant at 85 throughout, the volts impressed on the rotary at start were 61.5 and rose to 70 at finish. Another way of seeing the effect of the compound turns on the power factor of the line, is to run the rotary no load (reactance coils in the line), separately excite the compound turns, noting the current in them and the circulating A. C. current between the machines. This was done and the results were plotted as per curve (No. 10 and 11). The D. C. regulations with and without the reactance coils in the line are also shown (No. 9.)



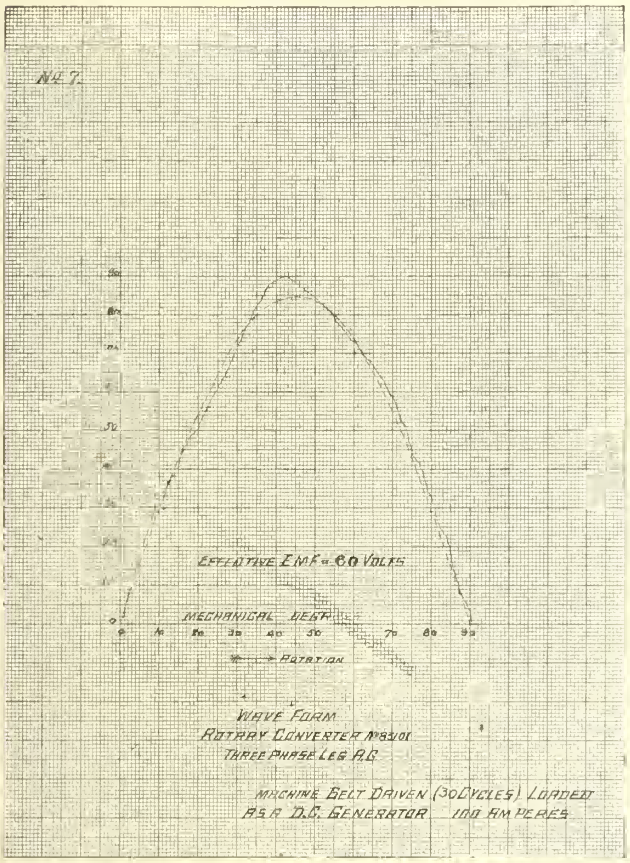






The frequency throughout was kept constant at 30 cycles. The following example is typical of the last experiment. Given a transmission line in which the receiver volts are to increase uniformly with load, 2880 volts at no load and 3100 volts at full load. The energy component of the current at full load being 52 amperes, at three-quarter load the current is to be inphase with the E.M.F. at the receiver end. The line impedance is $Z = 8-30j$. What must be the (constant) generator voltage, the current in the line and the power factor at the receiver circuit?

Let i = the energy component of the current
" i_1 = wattless " "
" I = total current $= i+ji_1$
" E_0 = Gen voltage.
" E = Receiver voltage.
Then $E_0 = E + I Z = E + (i+ji_1)(r-jx)$ or
$E_0 = E + i r + i_1 x - j(ix - i_1 r)$

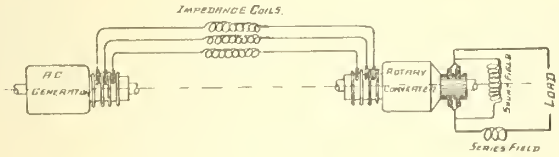

No 7.

From this formula everything may be calculated, since the generator voltage (terminal) is to remain constant at all loads. The numerical results are as follows :—

Generator Voltage = 3597

	No load	¼ load	½ load	¾ load	Full load
Volts line	2880	2950	3020	3090	3160
Energy current	0	13.00	26.00	39.00	52.00
Wattless current	23.75	17.80	10.01	0	—12.88
Total current	23.75	22.05	27.92	39.00	53.60
Power factor	0	59.0	93.2	100.0	97.0
Lag of current	90.°	54.°	21.°	0.°	—14.°

Polyphase rotaries are self-starting from the A. C. side, and may be thrown direct on the line. They will pull two or three times full load current at the start, but will come up into complete synchronism, which may be indicated by a phase lamp or by the field switch. One of the rotaries used had solid pole tips, and came into synchronism when thrown on the line, but another rotary with laminated pole tips would not, and required to be brought up to speed (from the D.C. side) and thrown on the line by the aid of phase lamps.

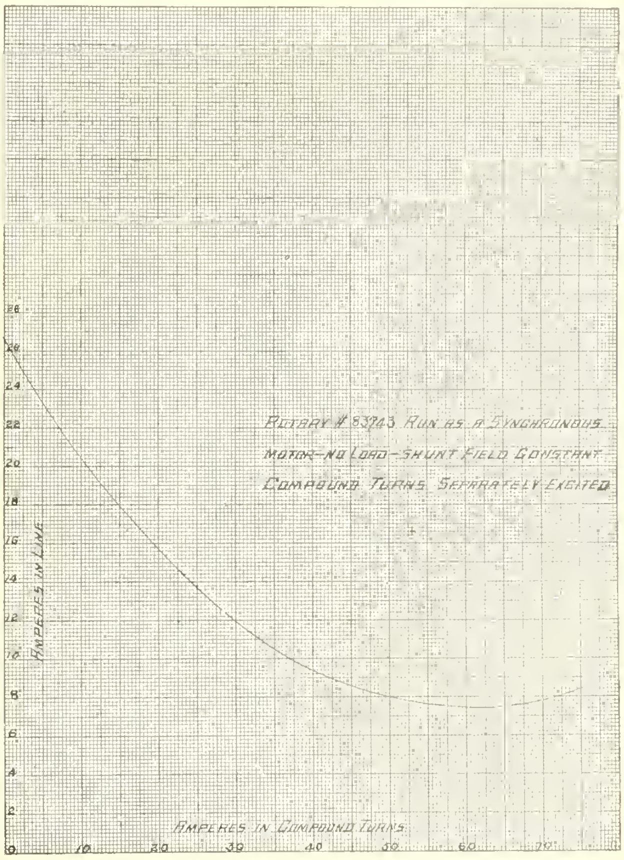


No. 8.

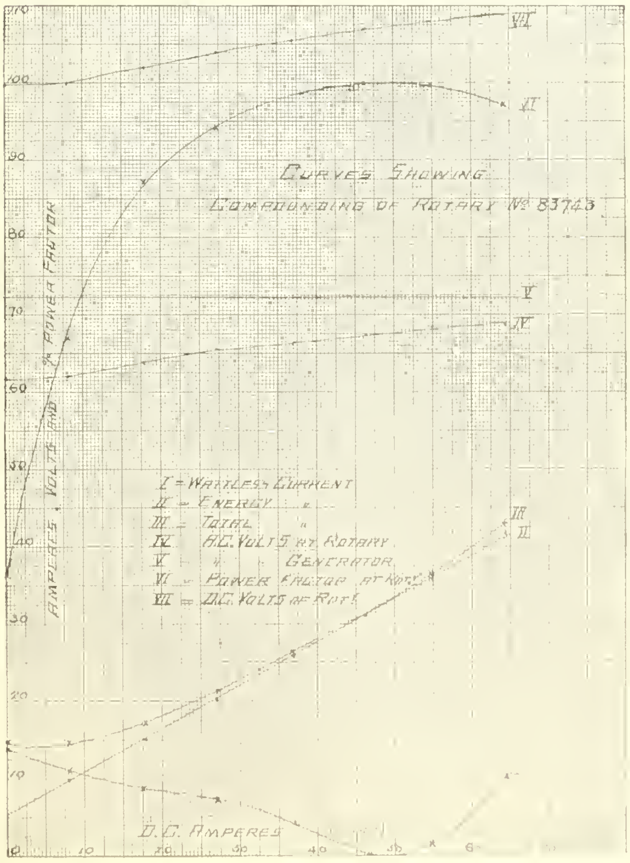
It was found that the first rotary would not come up into complete synchronism if the field switch was closed at the start, but would come up to about half speed and remain there. On opening the field switch, however, it would immediately run up.

As there are dangerous voltages induced in the fields (when left open) in starting in this manner, it is advisable to have the field circuit open in two or more places, as otherwise it would put too great a strain on the field insulation. The machines, when started up in this manner operate as hysteresis motors, hence the reason of leaving the field switch open. The D. C. polarity also depends on which pole the rotary synchronizes under, and therefore all D.C. meters should be out of circuit until the D. C. polarity is tested. Impedance coils may be used for starting in this manner so as not to affect the line voltage too much. Some means of cutting the fuses out of circuit at the start should also be provided.

Since single phase rotaries are not self-starting, and the alternating and continuous currents do not neutralize one another, it is more advisable to use synchronous motors and continuous current generators. It is now the general practice to magnetically connect rotaries on their A.C. side when they are required to run in parallel from the same line. This allows of their being connected in series on their secondary side without causing the short circuit which would otherwise occur. It also does away with the circulating current, which otherwise occurs when they are connected in parallel on the primary and secondary sides, rendering the D. C. readings valueless.



No. 10.



No. 11.

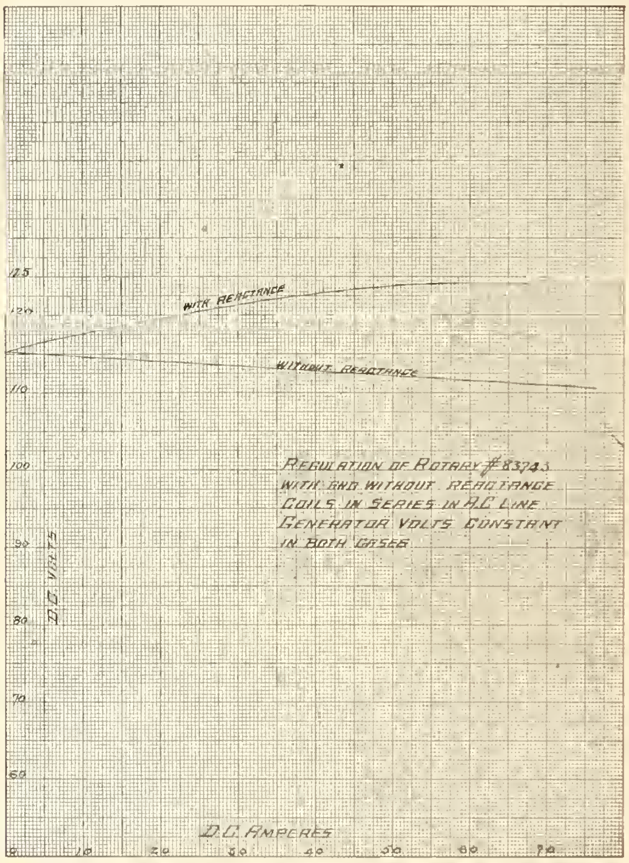
ROTARIES IN STREET RAILWAY WORK.

In street railways it is very often necessary to cover very large districts. This means very large feeders to keep the drop of potential within limits. This requires a large outlay for copper and installing, neither is it very efficient.

The easiest way to overcome this is to have one main generating station and several sub-stations. In this station would be placed alternating current generators, and the power should be transmitted to the sub-stations, where there would be placed synchronous motors driving continuous current generators or rotary converters.

As rotaries allow of a simpler means of converting alternating current into continuous current, also being more efficient and allowing of better potential control, they are now nearly always installed for railway work.

On account of D.C. potential being directly proportional to the A.C. potential, it is necessary to have some means of controlling this in a long transmission line which has considerable resistance and self-induction. As railway load fluctuates a great deal, it would be difficult to keep the potential constant at the terminals of the converter, especially as the current in the line may remain the same and still the conditions of load at the other end might vary a great deal. Take the case where current is leading or lagging; a watt meter in circuit might read the same watts, but in the first case the potential at generator should be lowered and in the latter should be increased. It is therefore necessary to be able to regulate the potential at converter. This can be done by changing field excitation of rotary; that is, changing phase relation of current and therefore increasing or decreasing the potential at the converter, as shown by the previous experiment.



No. 9.

Now, as a convertor is a synchronous motor on its A.C. side, we will have same E.M.F.'s acting as in a synchronous motor.

1st. The impressed E.M.F. at terminals.
2nd. The counter E.M.F. of converter.
3rd. The E.M.F. consumed by impedance.

The impressed E.M.F. depends on generator E.M.F. The counter E.M.F. is proportional to field excitation, and as its speed is constant, this counter E.M.F. is independent of load on the machine. The E.M.F. of impedance changes with load, and is proportional to load. The following diagrams (No. 12, 13 and 14) will show how generator voltage has to be varied to keep constant voltage at receiving end when phase relation of current is varied.

I.—When current is in phase with E.M.F.; that is, a non-inductive receiver circuit.
II.—When current lags behind E.M.F.
III.—When current leads E.M.F.

I R = ohmic drop.
I X = reactive drop.
I Z = impedance drop.
O I = total current.
O E = voltage at machine.
O E_0 = generator voltage.

As these diagrams are drawn to scale, we can see how generator voltage varies with load to keep receiver voltage constant.

For accurate results the analytical method should be employed rather than the preceding method. The analytical method is as follows:

e_0 = generator voltage.
e = receiver voltage.
i = energy current.
i_1 = wattless current.
I = total current $= (i + j\,i_1)$.
Z = impedance of line and generator $= r - j\,x$

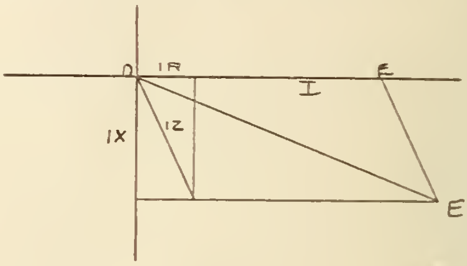
Now $e_0 = e + i\,Z$ (vector sum).
$= e + (r - j\,x)\ (i + j\,i_1)$.
$= e + i\,r + i_1\,x - J\,(ix - i_1 r)$
$= e + i\,r + i_1\,x)^2 + (i\,x - i_1\,r)^2$ – I

At non inductive load $i_1 = 0$.
Then $e_0^2 = (e + i\,r) + i^2\,x^2$——II.
At no load $i = 0$ very nearly compared with i_1.

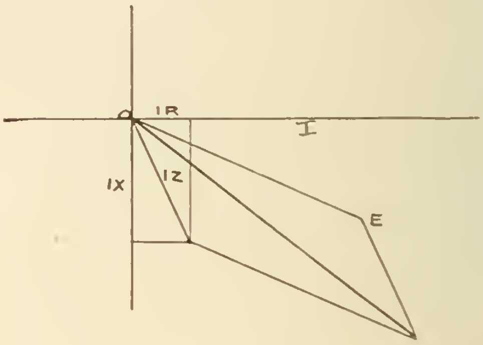
$$e_0^2 = (e + i_1\,x)^2 + i_1^2\,r^2 \text{——III.}$$

Now, as a converter can be made to take lagging or leading currents, the receiver E M F can be varied at will.

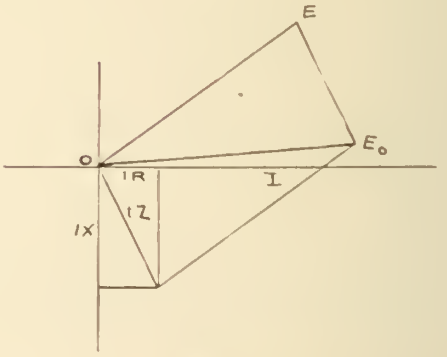
Having decided at what point you wish to run non-inductively,



No. 12.



No. 13.



No. 14.

it is necessary to calculate the running light current and to adjust the shunt and series field for same. From II and III the running light current may be obtained.

$$e_0^2 = (e + i\,r)^2 + i^2\,x^2 \text{——II}$$
$$e_0^2 = (e + i_1\,x)^2 + i_1^2 r^2 \text{——III.}$$

Therefore $(e + i\,r)^2 + i^2\,x^2 = (e + i_1\,x)^2 + i_1^2\,r^2$.

$$i_1 = -\frac{e\,x}{Z^2} + \sqrt{\frac{e^2\,x^2}{Z^4} + i^2 + \frac{2\,e\,i\,r}{Z^2}}$$

If e = 1 and if it is to be non-inductive at full load, let I = 1

$$i_1 = -\frac{x}{Z^2} + \sqrt{\frac{x^2}{Z^4} + 1 + \frac{2\,r}{Z^2}} \text{——V.}$$

If non-inductive at $\frac{3}{4}$ load

$$i_1 = -\frac{x}{Z^2} + \sqrt{\frac{x^2}{Z^4} + .56 + \frac{1.5r}{Z^2}} \text{——VI.}$$

From these equations we can get the running light current. The following would be the currents running light where converter would run non-inductively at full load Z = .1 – .4j.

r	x	Z^2	i_1 % of full load current.
.10	.40	.17	.42
.20	.40	.20	.64
.30	.40	.25	.84

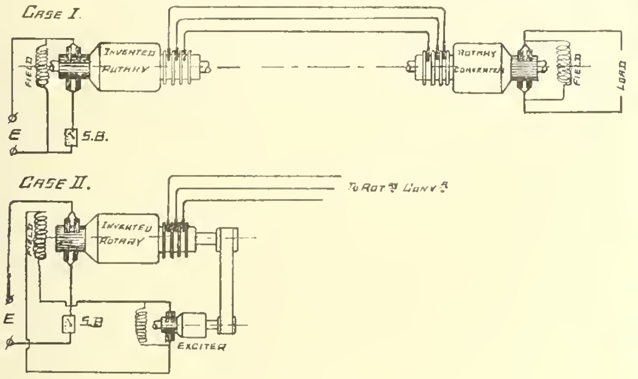
Converter to run non-inductively at $\frac{3}{4}$ load.

r	x	Z^2	i_1 % of full load current.
.10	.40	.17	.31
.20	.40	.20	.45
.30	.40	.25	.63

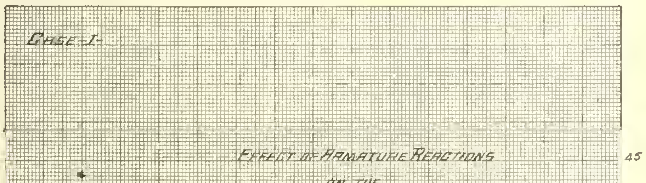
From these results we see the effect of the energy loss on running light current. It is also evident the more the energy loss the higher should the generator voltage be relative to the converter voltage. It also shows that it is better to run the converters non-inductively at ¾ load, as before stated.

INVERTED ROTARIES.

In some cases rotary converters are used to change continuous currents into alternating currents, or as inverted rotaries. Trouble arises immediately when the power factor of the line changes to any extent as it is accompanied by a change in the frequency of the machines. The reason of this is very readily seen. A continuous current shunt motor will speed up and down according as its field is weakened or strengthened, and for the same variation in field strength at light loads its speed will change more than at full load. As an inverted rotary is nothing more or less than a D. C. motor running light, a very small change of field strength is accompanied by a large variation in speed. The effect of lagging and leading currents on an inverted rotary is to speed it up and down. One way of getting over this difficulty is to strengthen the field of the inverted rotary, as lagging currents come on or weaken it for leading currents. An ingenious and automatic way of meeting this difficulty was devised and put into practice by Mr. B.G. Lamme, which is as follows:



No. 15.



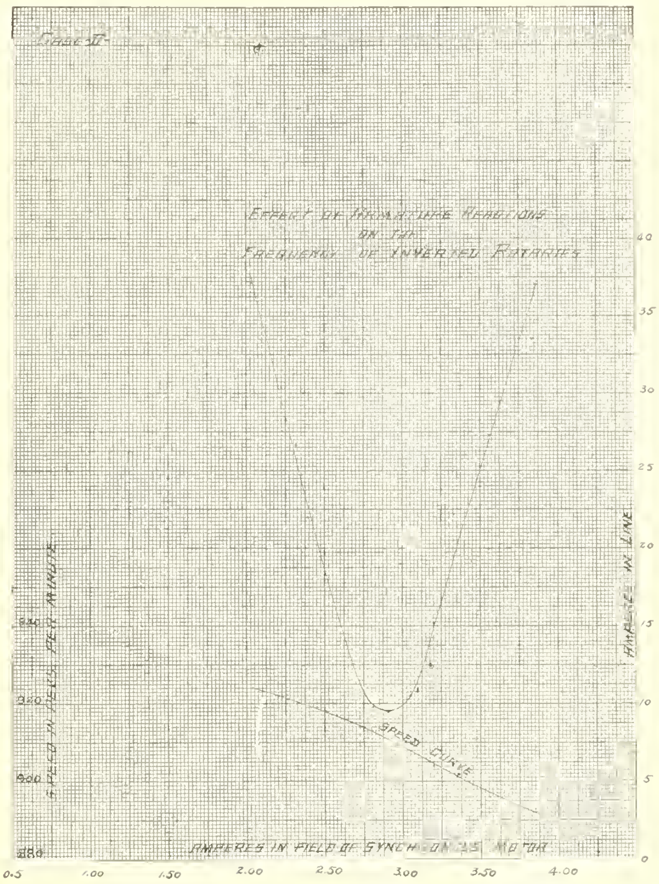
The inverted rotary is made to drive its own exciter which may be placed on the end of the shaft or belt driven from it. (No. 15.)

The exciter should be worked low on its magnetization curve so that a small variation of speed is accompanied by a large variation of voltage. Supposing that there was a lagging current on the lines the speed would rise, but the speed rising would strengthen the field, and if the one tendency were made to counteract the other a constant speed would be obtained. The following are the results of experiments carried out to show these effects. The exciter not being a specially designed one did not keep the speed absolutely constant but its effect is clearly seen.

In case I and II the voltage impressed on the armature of the inverted rotary was kept constant throughout and in case I the field current was also kept constant, thus any variation in speed would be due to armature reactions.

To get a large variation of power factor the field current of the rotary converter was varied and speeds as well as circulating currents were taken and plotted with field currents of the rotary converter as abscissae.

The effect of the exciter in case II is very readily seen, as for the same variation of field current in case No. I the speed changed from 900 to 1036 revs. per min. and in case II the change was from 892 to 926. If the inverted rotary were equipped with a compensating exciter similar to the one patented by Mr. Rice, of the General Electric Co., then theoretically the frequency would be constant.



Another way which might be used is to automatically vary the field by having a Siemens epicyclic train, one wheel connected to the rotary, another to a constant speed motor, and the third connected to the field rheostat.

As regards to their practical operation inverted rotaries are now being used to advantage in transmitting continuous current power (from large D. C. power stations) long distances.

CONDITION OF OPERATION OF STREET CARS IN THE CITY OF QUEBEC.

By D. E. Blair, B.Sc., Chief Electrician Q.R.L. & P. Co.

Of all financial undertakings, none perhaps depend more upon the nature of local conditions than does the successful development of a city street railway system, and for this reason it may be of interest to the members of this Association to have before them a more or less general discription of the difficulties encountered and overcome by those responsible for the development of the Quebec Street Railway.

Quebec, as a city, has many distinctive features that are not to be found in any other city in America, and the stranger within its fortified walls is very soon struck with the unique fashions, methods and temperament of the quiet people who make up what may be called the native population, numbering about 75,000, and of which about 65,000 are French-speaking.

When the construction of the road was first contemplated by those responsible for the promotion and fulfilment of the scheme, there existed certain unpromising conditions which tended to arouse the doubts of many as to the feasibility and possible financial success of the enterprise. Of these I might mention a few at random. Business, in general, is carried on in a very quiet and matter of fact way, and an observant critic does not notice the hustle and bustle so common in most modern cities of this continent.

The salary of the clerk and the wages of the laborer are moderate, and the average individual very seldom seems inclined to do any more than he is paid for.

The natural result of this state of affairs is that the electric street car was not likely to be looked upon as a valuable and indispensable time-rover, as well as a welcome convenience, but rather as a luxury to be enjoyed by those who could afford it.

The manufacturing interests of the city are limited, and further development along this line is hindered by the somewhat strict conservatism of capital. Further, the average laborer or even expert workman is the proud possessor of a large family, several of whom are perhaps engaged in the same work as himself, and he finds it convenient and economical to live near his work, as rent in the manufacturing districts very reasonable.

The city is very compact and densely populated, being furthermore divided into certain sections which are practically self-contained municipalities. Public entertainments and social functions were very little appreciated or patronized, and the principal streets seemed almost deserted after 9 p.m.

Although these conditions may have no direct bearing on the practical expenses of construction and operation, they were certainly not in favor of the credit side of the prospective railway company's cash book.

The more formidable objections, however, were of a practical nature. Five years ago, and even less, it was considered impossible that anything that looked like a street car could ever climb the steep, narrow and winding thoroughfares that lead from the water's edge to the highest points of the solid mass of rock upon which the city is built. Besides this, the heavy snowfalls, coupled with the narrowness of the streets, were likely to be a great hinderance to the service, but in spite of everything the completion of the road was finally rushed through, and it has now been proved that the limiting conditions of the street railway operation were not overstepped in the bold undertaking which has given the people of Quebec a reliable and efficient means of transportation. The city has improved wonderfully since the inauguration of the road, and promises to become, before long, as wide-awake and progressive a centre as any in the country. Even theatrical entertainments have become more or less popular and everything seems to be moving at a faster pace than heretofore.

On the 1st November, 1896, was commenced the laying of the rails through the main streets of the city, and on the 1st July, 1897, the road was open to traffic.

Specifications of track were as follows:—72 lb. 6" steel T rails in 30 ft. lengths by Cammell & Sons, England. Standard gauge laying on 7" ties at 28'.0 centres.

Each joint to be double rounded by two-00 solid copper wires in Eclipse copper bonding caps by Ohio Brass Co., these to be tinned and ends of wires riveted on outside of rail. Double cross bands to be placed at every 5th joint—150 feet.

OVERHEAD CONSTRUCTION.

Tubular poles 28 ft. long, weighing 700 lbs., and spaced 90 ft. apart, are used throughout. Insulation is of "Dirigo" type and trolley wire No. 00 hard-drawn. Span wires of standard galvanized steel wires 3/8" in diameter. Lightning arresters of Wurts' non-arcing type. All construction is elegant and of a substantial nature. Altogether there are 10 miles of span wire construction and 2½ miles bracket.

CAR SHEDS.—Of these there are two, one in Upper Town 210 x 120 ft., having 14 tracks and 7 doors, where all cars in service are laid up at night. The other is in Lower Town and is used for storage purposes only. The capacity of the working car shed is 52 cars, and here all repairs are done. There are seven floored pits communicating with the machine and blacksmith shops underneath. It has been found cheaper to manufacture most of the repair parts than to purchase them from supply dealers.

PAVING.—At this time all streets, without exception, were covered with a generous laying of macadam. Within the last two years, however, a great improvement has been made in this respect on nearly all the streets through which the lines run. All macadam was removed to a depth of about 12 inches, leaving the ties completely exposed, and these were then filled in with concrete to within about 4" of the top of the rail. The facing of the new pavement throughout the city now consists of Scoria blocks between and 8" beyond the rails, while the remaining strip of roadway is filled either with asphalt, asphalt brick or scoria blocks, according to the grade of the street.

In Upper Town, the residential district of the better class of people, the streets were nearly all wide enough to permit of a double track, but even here it was found necessary to run through certain sections on single track.

Lower Town, the business section of the city, is a semi-circular strip of varying width and of a practically level ground which is surrounded on the outer edge by water, and lying beneath the cliffs which mark the boundary of Upper Town. Here the lines are all single track with the exception of one section, where two parallel streets converge into one wide street ¼ mile in length. The main street which runs through the entire length of this section is about 2½ miles long and is so extremely narrow in places that there is hardly room for an ordinary vehicle to squeeze past on either side of a car, on the single track in the centre of the street.

The return line is run through a maze of narrow and unsymmetrical side streets which seem to run in almost any direction until they form a junction at an oblique angle with one of the largest arteries, thereby losing their identity.

On one section of the line, one mile in length, there are no less than eleven curves of from 35 to 40 feet radius at intersections of about 90 degrees, one of which requires a reverse curve of 40 feet radius.

On all these streets the inner rail is placed within two feet of one sidewalk in order to leave room for single vehicles to pass a car on the other side.

The Upper and Lower town lines are connected by two cross town lines which ascend obliquely along the face of the cliff. One of these, the Green Line, runs through the public thoroughfare which, though very steep, is yet feasible. The actual length of this line is 3440 feet, and the difference of level between injunctions is 172 feet, which is equivalent to an average grade of 5%. The total length is made up of sections of 200 ft. 12½%, 100 ft. of 10%, and 600 ft. of 9.5% grades, the rest of the line being nearly level. All these grades have sharp curves in their lengths, but the most difficult to operate is the first. This one begins to rise at a gradient of 11½%, and terminates at 14.15%, these being a 40 ft. rad. curve at the top, of which one half is on the heaviest part of the grade.

The second cross-town line runs for a certain distance down Palace Hill at an average grade of 11% and then turns off the public street at an angle of 80° on to a steel trestle which runs parallel with the face of the cliff at a gradient of 7.5% for 800 ft. The total length of this line is 1300 ft., with average gradient of 6.85% and a maximum of 12%, difference of level being 89 ft. One disadvantage in the operation of this line is, that when a car leaves the trestle to take the 115% grade it is running at half speed and must be accelerated on grade. This means a very heavy drag on the motors for the first 50 ft. of the climb.

CAR SERVICE.—The Upper Town service consists of a double belt line, 3½ miles in circumference, with from 4 to 7 cars running in each direction on a 4 minute headway in summer and 5 minutes during the winter. Schedule speed on all lines is approximately 8 miles per hour, except for a few short stretches of level; the total length of this belt is layed on streets having a gradient of from 4% to 8%.

In Lower Town there is but a single belt line, both branches of which are intersected by the cross-town lines. Cars running west are for most of their run within one block of those running east. Here also cars are run on a 4 minute headway and the service requires from 8 to 10 cars. Free transfers are issued from one belt to the other over the cross-town lines. These are run separately in winter, but two sides of a double rectangular belt line in summer. Both tracks are single and crossings are made at turnouts.

Strict regulations govern the operation of cars on grades and sharp curves. On some of the grades stop-boards are placed top and bottom and the motorman cannot proceed until signalled by the conductor. Speed down grade must not exceed 4 miles per hour. As a result of these precautions, runaway cars are very rare, and have never yet been attended by any serious consequences.

The average number of cars in regular service during the summer months is about 35, and in winter about 30.

BRAKES.—In every city of grades, such as Quebec, the system of braking should be of special interest, yet hand brakes are used throughout, the effective leverage being 100 to 1.

The brake shoes in use are of very soft cast iron, and it has been found that the retarding force due to the application of this shoe is much more evenly supplied and that the co-efficient of friction is higher under all conditions than it is when hard cast iron is used. This is especially the case in frosty or snowy weather.

New shoes weigh 19½ lbs. and wear down to 4½ lbs. Average life is 6150 miles, or 410 miles to the lb. of wear.

WHEELS.—All wheels used are of ordinary chilled cast iron 33" diam., weighing 425 lbs. each and mounted on 4" steel axle. Of these removed from cars during the first three years of operation there is not a great proportion of "flats," as will be noticed from the accompanying table.

	Wheels removed......	125	pairs	
Of these	Worn out............ ..	94	"	75.2%
	"Flats"..	23	"	18.4%
	Broken Flanges..	8	"	6.4%

Average life, 24,800 car miles.
Maximum " 49,000 " " (reached by 10 pairs).

CAR EQUIPMENT.—The car equipment consists of: Thirty-five 28 feet double vestibule closed cars, weight fully equipped 14,500 lbs., seating capacity 30; 24 double and open cars, weight 16,500 lbs., seating capacity 50; 6 double ended snow sweepers; 2 double ended wing plows; 1 street sprinkler; 1 "converted" horse car.

ELECTRICAL EQUIPMENT.—The electrical equipment is standard throughout on all rolling stock and is of Westinghouse manufacture. It consists of 124 No. 12 A-30 horse power motors; 124 No. 28 A controllers; 62 sets controlling resistance.

All closed cars are fully equipped and in service during 12 months of the year, and the extra equipment required for sweepers and snow plows during the winter are borrowed from the open cars.

The sweeper and plow equipments are necessarily very much overloaded at times, and it will be of interest to some here present to know how they have stood the hard usage.

OVERLOADS ON MOTORS.—An overload of 100% for several minutes at a time has often been carried by these during heavy snow storms, and a sweeper will sometimes burn five or six No. 13 B & S copper wire fuses, or in other words draw from 200 to 250 amp. at 520 volts before it can get past a difficult spot. This extremely hard usage does not seem to have any very bad effects beyond a temporary softening of the armature insulation and sometimes the loss of a certain amount of solder from the commutator connections, and the management are proud to say that they have not had a single armature burned out since the road has been in operation, in fact the only trouble they have ever had with an armature is that in two cases the insulation was scraped off the wires by rubbing against the pole pieces in consequence of a defective bearing. This is not a bad record considering that there were 124 of them in use. There has never yet been a commutator lost, or even has it been necessary to repair one, apart from resoldering a few melted connections, and the heaviest wear on any diameter up to date is 3/8 inches, and the average wear taken from the first 28 closed cars in operation is 22 inches on the diameter after having made an average run of 71,800 miles. There has not been a commutator "flashed" or "bucked" in the past 18 months, and this perhaps is largely due to the excellent quality of brush used, as well as to the constant care that they receive.

CARE OF MOTORS.—It has always been the practice to send an armature to the lathe at the first sign of a "buck," and it has been found that this is absolutely the only way to prevent a re-occurrence of the trouble.

A sharp eye is kept on the brushes to see that they do not wear down too far or become gripped in their holders, and commutators are cleaned and sandpapered about once a week with No. 0 sandpaper, although it is quite common for a commutator to keep a nice chocolate glaze for over a month without being touched.

The commutator is the most delicate and troublesome part of any electric equipment, and there are two or three more points which ought to be strongly recommended in its care:

1st—To send it to the lathe before it has worn down too far. Just as soon as a slight shoulder is formed at each side of the wearing surface, the brush is lifted by the end play of the armature and unnecessary and expensive sparking is the result. Further, the copper segments are rarely of a uniform boldness throughout, and the least inequality of wear soon develops into a low spot on the commutator.

2nd—It is very important that the brush springs be set at the proper tension, and it is easy to make a rough comparative test of this statement with no other tools than a pair of calipers or steel tape line and an angler's spring balance. It will be found that too light is just as serious a defect as too heavy a tension, if not more so. In one case excessive wear is due to sparking and probable "flashing," and in the other to actual friction.

3rd—See that brush-holders are accurately aligned so as to divide the current equally between the two circuits of the armature. If the brushes are but the thickness of one segment out of place, one is liable to be notified of the fact at the first heavy overload on the motor. Of course a great deal depends upon the quality of brush used, and cost price of this article should not be considered.

The brush used here averages a life of 12,600 car miles and costs 15c. a piece, which is more than most brushes of this size on the market, but let any one just make a simple calculation to see how many times the difference in the price of the brush goes into the saving effect by prolonging the life of a commutator several years.

The cost of renewing one commutator would keep a 50 car equipment in brushes for two years.

(I have now to apoligize for having perhaps tired you with detail, but I feel that a great deal more could be said on this subject if time and courtesy permitted.)

Some trouble has been experienced during the snow storms of winter by the grounding of field coils, but means have been found to effectually prevent this in future. I might here mention that during 12 hours of a cold dry snow storm, when light particles of snow are flying about, 2 or 3 gallons of water are sometimes collected in the bottom of the motor casings. Water and slush in the spring time have given no trouble.

A word about controllers. Aside from the burning out of a couple of magnetic blow-out coils, there have never been any repairs made on any of the 124 controllers in service beyond the renewing of the sparking tips of the drum, which is done about once in two years at cost of about 50c. a controller.

Here again are the results attained by vigorous inspection and careful cleaning each night.

Apart from the nightly inspection it is the practice of the road to thoroughly overhaul every car once in every six weeks. This work is done in day time. Bearings and armatures are examined, brush springs set, brake rigging adjusted, and journal boxes examined and renewed if necessary.

As a result of this routine work, which costs but little, it is seldom that the service has to suffer the annoyance and blockade of traffic caused by a disabled car on the road. It can be safely said that there are not more than 2 or 3 cars ever pulled out of service for any reason whatever from early spring to late in the fall. In winter the number is somewhat greater.

CURRENT CONSUMPTION OF CARS ON GRADES.

The current required to get a loaded car up the steepest grades on a good summer rail, is practically constant and well within the overload capacity of the car motors. The maximum amount usually drawn from the line at 520 to 540 volts under such conditions is rarely above 125 amperes, and that for a short time only. The average current is from 60 to 80 amperes per car.

Just as soon as the appearance of snow or ice on the rail has to be considered, the ascent becomes a more serious question. Wheels begin to skid and the car loses momentum, then sand is applied, and the sudden overload on the motors as the wheels take a grip is often beyond the capacity of the heaviest fuse wire it is safe to use on the car equipments, viz., 14 B & S. This wire will carry 180 amperes for several minutes in winter time and 200 amp. for about 10 seconds, and this will give a rough idea of the power required. The rated capacity of the motors is 50 amp., so that when running on the parallel connection the rated load per car would be 100 amp. In other words, every equipment on the road has frequently to stand each day an overload of from 50 to 120 per cent. These figures, however, are yet too low for the current consumed at times by the driving motors on the sweepers. On these there has been frequently measured an overload lasting an appreciable time of 180% to 200%. Apart from these sudden maxima, the average load distributed between the two motors sometimes averages 150 amp. for hours at a time, including several short periods of comparative rest. Some, I know, will say that it is extremely bad practice to strain an equipment to such an extent but, without denying the charge, it may be said that these sweepers have cleaned over 6,000 miles of track every year for the last three years, and the only mishap which occurred to any one of them during the third year of their operation was the grounding of one field coil, this too in spite of the fact that they were on one occasion running for 106 hours continuously, each one wearing out 3 or 4 sets of brooms during that time. On several occasions they were running continuously for two or three days, except for an occasional stop of an hour to renew the brooms.

Curve No. 2 shows the average power required by each car in service during each month of the year. These curves are calculated from the readings of an integrating wattmeter in the central station.

The total cost of maintenance of electric equipment per car mile per year is 17c.

EFFICIENCY OF MOTORMEN.—The car service calls for a working staff of 70 conductors and as many motormen. All motormen before being accepted on the road must go through a period of training averaging from three weeks to a month. Part of this time is spent on the road in the company of a good regular motorman, and at least a week is spent in the car sheds, where the novice acts as helper at nominal wages. He is then examined as to his knowledge of the road, car equipment and regulations. Very little technical knowledge is required beyond a thorough understanding of the different parts of the equipment. As a result of this discrimination against the blockhead and the fool, it is a marked fact that on every car in service, "the man behind the gun" knows his business and uses his brains to the advantage of the company.

SNOW AND ICE.—The greatest difficulty encountered by the Railway Company in its efforts to provide a regular and efficient car service during the winter months, is the clearing away of the snow from the tracks. It is not so much that the snowfall is somewhat heavier than in Montreal and Ottawa districts, as that the extremely narrow strips of roadway either one side of the track or the other, soon become piled up with snow to such an extent that all snow removed by a passing sweeper immediately slides back on to the rails and blocks the passage of the following car.

Another serious disadvantage is that all cars in the city have to run over some sections of single track. This fact requires, of course, that cars shall make regular crossings at certain points, and if one car should be late for—or worse still, not reach—its crossing point, several of the following pairs of cars which cross at the same point will be stalled there until the tangle is straightened out. A delay of this sort is disastrous in many ways, because the leading car, when it gets away, has sometimes to plough its way through a heavy accumulation of snow until it is, possibly, extricated from its sorry plight by a passing sweeper, which has to be signalled and shunted past the waiting cars before it can be of any service. Matters are soon straightened out, but then that sweeper should have been somewhere else and there is more trouble ahead. Just as long as all cars make their proper crossings, no matter if they be a few minutes behind scheduled time, everything works smoothly, and after that, complications seem to increase in geometrical progression.

It is the practice to send out the "wing plows" as soon as a certain amount of snow has fallen, and these follow the sweepers around the whole length of the track, at regular intervals, pushing the snow piles back as far as six feet from the rail where it is possible, although there are miles of track to be kept open where there is less than that distance between the rail and the actual buildings, to say nothing of the sundry poles and sidewalks that necessarily intervene.

As the day wears on and the snow still continues to fall, the swing of the plows is limited to two feet and possibly to one foot, after which it is a hard struggle to keep everything moving through the rectangular channel four to five feet deep which has been formed by the wing plows in their endeavors to clear the right of way.

There are several bad spots at which it is absolutely necessary to keep gangs of snow shovellers at work as soon as the storm reaches any more than even moderate proportions.

It has further been necessary on two or three occasions to pull all cars out of service in order to give the tireless sweepers a chance to keep the road open, but only once in 1898 and once in 1899 has the service been entirely blocked, and that for one day only.

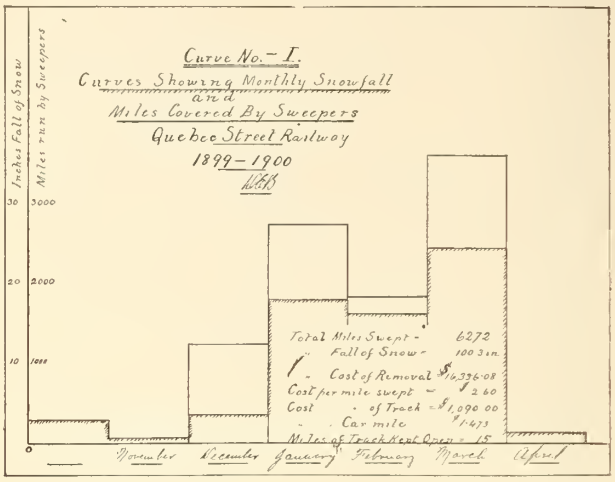
Nearly all cars in service now carry side brooms or flangers about three feet in length, which are set obliquely across the rails about one foot ahead of the front wheels. These consist of cast frame, into which are fastened a number of cuttings from the sweeper brooms about ten inches in length. They cost very little and have proved of invaluable service in keeping the rails clear of snow during the hourly or half-hourly intervals between passing sweepers; in fact, the car service very often depends entirely upon these to get through a light snowstorm, a couple of sweepers being sent out, after it is all over, in order to clean up.

These long brooms have another great advantage over a narrow steel wire brush in that they keep the snow and ice at each side of the rails at an easy slope toward the bottom, instead of cutting a deep rectangular trough which remains filled with snow after the sweeper brooms have gone over the track.

Since adopting these brooms on the road, a marked decrease in the power consumed by the rolling stock during storms is noticed, and a great saving has been affected in the quantity of rattan used by the sweepers for each mile of sweeping. This results from the fact that when the transverse section of the winter roadbed is properly graded the sweeper brooms need not be let down so far in order to clear all snow from the rail, thus saving a great deal of breakage.

The average snowfall in Quebec for the last three years has been as follows: 1897-98, 104.6 inches; 1898-99, 120.6 inches; 1899-00, 100.3 inches.

Curve No. 1 shows the proportion of last year's total fall during each month, also the number of miles covered by the sweepers during each month of the same year. Further data relative to cost of removal will be found beneath. These include all cost of sweeping, shovelling and carting away of snow, as well as the interest, depreciation and maintenence of the necessary equipment.



With reference to the removal of snow, the city by-laws enact "that proprietors or occupants shall remove the snow and ice from their roofs and from the streets, from the street line to the centre of the street, and keep the same within two inches of the pavement."

The by-law granting a franchise to the Quebec Railway, Light & Power Co. enacts "that the company shall remove the snow from their tracks and two feet on either side thereof." As the Company could not see their way to carry out this regulation without having trouble with the proprietors or tenants, they every year make an arrangement with the tenants on that side of the street on which the Company throw their snow, to remove the same, paying them at the rate of 10 cents per lineal foot of their frontage, except in places where the snow is known to accumulate, where they pay at the rate of 15 cents per lineal foot. Consequently, all the Company have to do is to throw the snow off their tracks, leaving the proprietors to remove the same along with their own. With this arrangement the proprietors seem very well satisfied.

One can better appreciate the relative magnitude of the snow expenses when told that $1.54 has to be deducted from the daily gross earnings of every car in service during the year in order to make up the amount.

HEATERS.—All closed cars in service are heated electrically during six months of the year, the heaters being divided into 4 sections, two on each side of car, each pair being separately controlled. The current consumed by each pair is 4.9 amp., and it therefore requires 9.8 amp. at 520 volts, 5.1 k.w., to heat a car during four months of the year when both sides are in use, but during the months of November and April one side is quite sufficient to maintain a comfortable temperature within the thin shell which composes the car body.

Taking the average time of service of car at 18 hours per day, and the actual cost of the extra current required at 65c. per k.w. hr., the cost of heating one car is as follows:—

$$5.1 \times .65 = 3.21 \text{ cts. per hour}$$
$$58 \text{ " " day}$$
$$150 \times 58 = \$87.00 \text{ " " year.}$$

This is equivalent to .204 cents per car mile, and the maxim taught is, "don't use electric heaters in a cold climate unless you have the advantages of an unlimited water-power and station capacity." The interest on first cost, depreciation and maintenance of the heating equipment would not add more than 2 or 3°/。 to the figures.

The electric railway, as well as nearly all lights and motors in Quebec, are operated through a sub-station within the city, from a power house situated at the Falls of Montmorency. The power house is 150 ft. long and 50 ft. wide, and contains the following equipment; 3-600 k-w. 2 phase 66 eye 5,500 volt S.K.C. alternators; 1-750 k.w. 2 phase 66 eye 5,500 volt S.K.C. alternators; 1-600 k.w. double current 273-500 volt Westinghouse generator; 2-30 k.w. bipolar exciters.

All the larger machines are direct connected to 52 in. water wheels of 1000 h.p. capacity each, and operating at a speed of 286 revolutions per minute. They were built by the Stillwell Bierce and Smith Vaile Co., of Dayton, Ohio.

The power is transmitted to the city over 16 wires, carried on two separate pole lines. Each machine is fed into a separate circuit at Montmorency, but may be connected in parallel at the sub-station in the city. the sub-station consists of a substantial stone building containing the following machines: 2-600 k.w. 2 phase S.K.C. synchronous motors, taking current at 5000 volts direct connected to 2 500 k.w. 550 volt G. E. railway generators, 2-200 k.w. 2 phase 5000 volt synchronous motors direct connected to 4 125 light multi-circuit Brush arc machines.

Besides these are the direct connected starting motors required for the motor-generators, 2 exciters driven by induction motors, and all necessary transformers and switchboards for distributing the current to its various uses.

RAILWAY SWITCHBOARDS.—The railway switchboard contains besides switches, circuit-breakers, volt and ampere meters and field resistance—1 Thomson intergrating watt-meter, 2 Bristol recording ammeters, and 1 Bristol recording volt meter.

From the daily readings of the first has been prepared curve No. 2, which shows the current consumed by the railway cars during each month of the year. It will be noticed how much more power is required during the winter than in summer, in spite of the fact that fewer cars are in service, and the car miles run by each are fewer than in summer. It will also be seen that, during the month of February, each car consumes an average of 24 h.p. during a whole day's run.

The maximum overload capacity which the station is ever called upon to furnish the railway, is about 900 k.w., and a yearly average is about 350 k.w.

The peak of the summer load very rarely reaches 550 k.w. and is easily handled by one generator, although a 10 or 15°/。 increase over this load would be very liable to pull the synchronous driving motor out of steep, if of long duration.

Time has unfortunately not permitted the preparation of any accurate curves to tell the story of the station's output, but one may form an idea of the average fluctuations by an examination of the recording ammeter charts on exhibition.

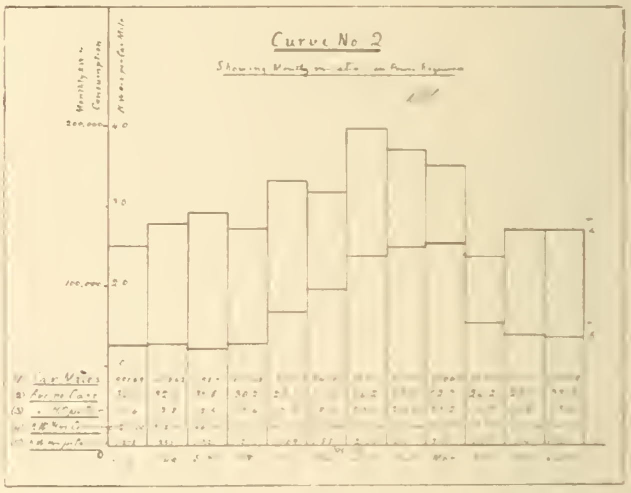
Before closing this very hurriedly prepared paper, it may perhaps be in order to make a few remarks relative to the conversion of the old Q. M. & C. Railway to an electric suburban line. This excellent roadbed now serves to carry a fast service of electric cars, interspersed with steam trains, which handle the heavy traffic between Quebec and the Shrine of St. Anne de Beaupre.

A trolley wire is suspended at a height of 22 ft. above the rail by stranded steel span wires hung from wooden poles, and the rails have been connected with single bonds of No. 00 wire for a distance of 26 miles. A copper cable of 300,000 C.M. area runs parallel with trolley wire for most of its length and is connected to the trolley every quarter mile.

This cable is fed at a pressure of 560 volts at 3 points, at Quebec, at Montmorency, 7 miles away, and at St. Annes, 21 miles away from the city, all power of course being generated at Montmorency and transmitted for ends of line at a high alternating tension.

Cars used are 50 ft. over all, mounted on Taylor trucks and each equipped with 4 Westinghouse 38 B motors geared to a speed of 45 miles an hour.

On account of the many stops to be made in the length of the line (18), a schedule time of 21 miles in 60 minutes has been adopted. This is quite satisfactory and fast enough, because the line is a very busy one in two ways. The number of passengers carried is beyond the highest hopes of the management, and it would be impossible to run any more trains over a single track and on train orders than are operated at present. There is every prospect of a second track being laid in the near future. The idea of running steam and electric cars is a novel one in this country, but is highly successful in every respect.



SPARKS.

The St. John's Electric Company, of St. Johns, Nfld., has sold out to R. G. Reid.

The ratepayers of Nelson, B. C., have sanctioned an expenditure of $15,000 for an electric light plant.

A committee has been appointed by the town council of Stellarton, N. S., to obtain information as to the cost of an electric light plant to be controlled by the town.

J. S. Dennis, a lineman for over fifty years in the employ of the G. N.W. Telegraph Company, was killed in Ottawa recently by the breaking of a pole on which he was working.

The town council of Newmarket, Ont., will ask the Lieutenant-Governor-in-council to authorize an expenditure of $10,000 to increase the electric light plant. If granted, the necessity of submitting a by law to the ratepayers will be removed.

"Polyphase Electric Currents and Alternating Current Motors, by Silvanus P. Thompson, B.Sc., B.A., F.R.S: This work is of considerable value to the electrical fraternity, as it treats of polyphase currents and alternating current motors and their application to various services in a most exhaustive and thorough manner. The book consists of 508 pages, divided into 20 chapters, and contains 358 illustrations, 24 of them in color, and eight folding plates. There are reviewed such interesting subjects as Combination of polyphase circuits and economy of copper, structure of polyphase motors, polyphase electric railways; properties of rotating magnetic fields, etc. It is the second edition, and bound in cloth, retails at $5. The publishers are Messrs. Spon & Chamberlain, 12 Cortland Street, New York.

CONVENTION NOTES.

Mr. E. E. Cary's graphophone entertainments were well attended and much appreciated.

The Association did a fitting thing by recognizing the services of ex-president Yule in connection with the work of the Legislative Committee.

Mr. J. J. Wright, Mrs. Wright, the Misses Wright, and Mr. and Mrs. A. B. Smith went down to the convention in Mr. Wright's yacht, "The Electra."

The evening excursion among the Thousand Islands on board the steamer "America," equipped with a powerful searchlight, was most enjoyable.

During the convention the home of Mr. Fred. Simmons, electrician, Princess street, was decorated especially with variegated colored incandescent lights.

Mr. Higman, of Ottawa, one of the stand-by's of the Association, was among the absentees at this year's convention, having been on a visit to the Pacific coast.

Many regrets were expressed at the absence of Prof. Owen, who was prevented, by the death of his sister, from attending the convention and presenting his promised paper.

The unavoidable absence of Mr. A. A. Wright, of Renfrew, and Mr. Geo. Black, of Hamilton, two veteran and useful members of the Association, was the subject of regret.

The weather was a trifle too warm for comfort, and induced a disposition to give the social features preference over business. A cooler month should be chosen for the meeting at Ottawa next year.

The kindness of Chief Hughes in conducting members through the penitentiary and explaining to them the prison regulations, and other interesting features of this institution, was much appreciated.

Everybody voted Mr. Fred. Simmons a "hustler" in behalf of the success of the convention, and withal a jolly good fellow. He was ably seconded by Mr. Nickle, manager of the Kingston street railway.

Mr. Geo. M. DeGinther, representing the Holophane Glass Co., of New York, Mr. Philip H. Hover, of the New York Insulated Wire Co., and Mr. William C. Hubbard, of the Manhattan General Construction Co., of New York, were among the American visitors to the convention.

Mr. Burns, representing Messrs. Munderloh & Co., of Montreal distributed as a souvenir of the convention an attractive and useful pocket match box, having celluloid sides and nickle ends, bearing on one side the Canadian flag and on the other the name of the company and the device "Our lamps are matches—have a light." The company will be pleased on request to send one of these souvenirs to any member of the Canadian Electrical Association who could not attend the convention.

The Packard Electric Company had a magnificent exhibit in the large hall immediately above the council chamber where the sessions of the convention were held. Mr. Cary, the manager, is an adept at arranging exhibits of this kind, having gained his experience in connection with the National Electric Light Association conventions in the United States. The exhibit was most complete and artistic, and attracted much attention and praise. An Italian orchestra formed a pleasing accompaniment. We propose to more fully describe, and perhaps illustrate, this exhibit in a succeeding issue, being debarred from doing so in this number by lack of space.

The platform decoration and exhibition at the city hall—the work of Mr. I. H. Breck, of Kingston, was unique in design and most attractive. On either side of the neatly carpeted stair-way at the top step were two white square pillars. At the base in golden letters were the words "Fiat Lux" (let there be light). Engraved on the left pillar were the well known names of "Volta" and "Frakklin," while to the right appeared those of "Edison" and "Tesla." Surmounting the pillars was an archway made of galvanized iron letters two feet high, and attached to which the word "Welcome," brilliantly illuminated with 72 incandescent lights, blazed forth. Under the archway the typical emblem, a huge naturally tinted maple leaf, was lighted up with the letters "C.E.A." (Canadian Electrical Association) in red, white, and blue lights. Stretching to the right and left were green colored decorations and lights. Each side of the platform was handsomely furnished and carpeted, and lighted with handsome hanging and bracket lamps of the Packard firm, St. Catharines. All at the convention commented on the beauty and originality of design of the display, and citizens were loud in their praise of the exhibit, claiming it to be the best yet seen in Kingston.

Evidence has recently been taken in the matter of arbitration for the purchase by the city of Winnipeg of the lighting plant now operated by the Winnipeg Street Railway Company. M. J. A. Kammerer, of Toronto, was one of the experts examined.

The exhibitors of electrical apparatus at the Toronto Exhibition just closed were the Royal Electric Company, of Montreal; The Electrical Construction Company, of London, and Jones & Moore, of Toronto. The Royal Company had their usual attractive display, consisting of S. K. C. dynamos, direct current and alternating motors, transformers, arc and incandescent lamps, switchboard apparatus, etc. The Electrical Construction Company exhibited their well-known type of dynamo and several motors. The Goldie McCulloch Company, of Galt, exhibited their Ideal and Wheelock engines, also a number of gas and gasoline engines, which attracted more than ordinary attention.

PUBLICATIONS.

We have received, through the kindness of Mr. Frank M. Baker, a copy of the report on tests of street car brakes, as conducted last year by the New York Railroad Commission. After making most exhaustive tests, the Board of Commissioners gave the first place to the Electric Selector and Signal Company, second to the Peckham Motor, Truck and Wheel Company, third to the Sterling Supply and Manufacturing Company, and fourth to the G. P. Magann Air Brake Company.

"Modern Electric Railway Motors," by George T. Hanchett, S.B. This work is a discussion of current practice in electric railway motor construction, maintenance and repair, and is so written as to be easily understood by anyone who has had a thorough grounding in Ohm's law. It consists of upwards of 200 pages, abundantly illustrated, and treats of the various designs of motors in a most able manner. The publishers are the Street Railway Publishing Company, of New York.

The General Engineering Company, of Toronto, have just issued their fifth catalogue of the Jones Underfeed Mechanical Stoker, and have succeeded in producing a work worthy of special mention. In it the Jones stoker, improved and perfected, is fully described and illustrated, and strong arguments advanced in favor of the underfeed principle of firing. It also contains numerous statistics of tests, as well as testimonials from persons who have used the Jones stoker in Canada and the United States. The General Engineering Company of Ontario, who control this stoker for the Dominion, is now under the able management of Mr. J. J. Ashworth.

SPARKS.

The Brandon Electric Light Company, Brandon, Man., have been granted authority to increase their capital from $50,000 to $125,000.

The Canadian Electric Light Company, of Quebec, are arranging to sell power to a pulp company to be established at the Chaudiere Falls.

A motion has been introduced in the town council of Rat Portage, Ont., to enter into arbitration with a view to the purchase of the electric plant of the Citizens Electric Light Company.

At a recent meeting of the city council at St. John, N.B., it was decided to engage an expert to report on the cost of installing and operating a civic electric plant for lighting the streets of the city.

A company has been formed in Ottawa to take over the Conroy electric plant at Dechenes, Que. The capital is placed at $300,000. The power house at Dechenes was built from designs of Wm. Kennedy, C.E., of Montreal, the electrical apparatus being of the Canadian General Company's manufacture.

A school has been established by the United States government at Fort Monroe, Va., for the purpose of instructing regulars in the application of electrical machinery used in the army. The rules, published by the Secretary of War, provide that applicants must be under 25 years of age, unmarried, qualified as a gunner, a student of a correspondence school, or the owner of electrical books, and no applicant will be recommended unless he has sought for a year or more to become practically familiar with one or more classes of electric machinery or with some portion of the elementary literature on electricity.

MOONLIGHT SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.		Extinguish.		No. of Hours.
		H.M.		H.M.	H.M.
1....	P.M.	9.10	A.M.	4.30	7.20
2....	"	10.00	"	4.30	6.30
3....	"	11.00	"	4.30	5.30
4....	A.M.	12.10	"	4.30	4.20
5....	"	1.10	"	4.30	3.20
6....	No Light.		No Light.		.....
7....	No Light.		No Light.		.....
9....	No Light.		No Light.		.....
10....	No Light.		No Light.		.....
11....	P.M.	6.40	P.M.	8.40	2.00
12....	"	6.40	"	9.20	2.40
13....	"	6.40	"	10.00	3.20
14....	"	6.40	"	11.00	4.20
15....	"	6.40	"	11.50	5.10
16....	"	9.40	A.M.	0.50	6.10
17 ...	"	6.40	"	1.50	7.10
18....	"	6.30	"	2.50	8.20
19....	"	6.30	"	4.00	9.30
20....	"	6.30	"	4.50	10.20
21....	"	6.30	"	4.50	10.20
22....	"	6.30	"	4.50	10.20
23....	"	7.20	"	4.50	10.30
24....	"	6.20	"	4.50	10.30
25....	"	6.20	"	4.50	10.30
26 ...	"	6.20	"	4.50	10.30
27....	"	6.20	"	4.50	10.30
28....	"	7.00	"	5.00	100.0
29 ...	"	8.00	"	5.00	9.00
30 ...	"	8.50	"	5.00	8.10
31....					
			Total	....	186.20

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

ELEVENTH ANNUAL CONVENTION.

The Canadian Association of Stationary Engineers opened its eleventh annual convention in Engineer's Hall, 61 Victoria street, Toronto, on Tuesday, August 28th, at 11 a.m. Mr. James Huggett, president of Toronto No. 1, extended a few words of greeting to the delegates, after which the executive president, Mr. R.C. Pettigrew, of Hamilton, took the chair.

The following executive officers and delegates were in attendance: R. C. Pettigrew, Hamilton, president; G.C. Mooring, Toronto, vice-president; A.M. Wickens, Toronto, secretary; Chas. Moseley, Toronto, treasurer; W. Oelschlager, Berlin, conductor; W. Bear, Dresden, doorkeeper. Delegates—J. Huggett, A. Storer, H. E. Terry, W.J. Webb, N.V. Kuhlman, Toronto No. 1; G. W. Dawson, Hamilton No. 2; A. Ames, Brantford No. 4; R. W. Greene, Guelph No. 6; W. Steeper, Dresden No. 8; W. Oelschlager, Berlin No. 9; W. F. Chapman, Brockville No. 15; J. Uttley, Waterloo No. 17; J. M. Dixson and J.T. Smart, Toronto No. 18

Visitors during the convention included E. J. Philip, J. J. Main, J. W. Marr, W. G. Blackgrove, John Fox, W. Johnson, Geo. Bradley, W. D. Bly, Martin Mose, R. McCauley, P. Jaffnay, Alf. Butcher, S. Thomson, Fred Hamner, Wm. Bourne, W. D. Irwin, and James Bannon, of Toronto No. 1, and T. Graham (president). P. Trowern, H. McMartin, Jos. Hughes, J. Hamilton, W.T. Bateman and J. Richardson, of Toronto No. 18.

The first business of the convention was the appointment of the following committees:

Committee on Credentials—J. G. Bain, C. Moseley, J. Uttley. Committee on Finance—Jos. Smart, H. E. Terry, G. W. Dawson. Committee on Mileage—A. Storer, W.J. Webb, W. Steeper Good of the Order—J. M. Dixon, W. F. Chapman, J. Huggett, A. Ames, W. Bear and W. Oelschlager.

The president then read his opening address, as follows:

PRESIDENT'S ADDRESS.

Brethren,—It is with pleasure that I welcome you to our eleventh annual convention. You have been selected from the different Associations throughout the Dominion to legislate and enact laws for the welfare of the Canadian Association of Stationary Engineers. Before proceeding further, kindly permit me to thank you for the honor you conferred upon me in electing me unanimously to the office of president at our last convention. I can assure you that I appreciate the honor very highly, and while I have endeavored to fill the position in a fitting manner, I fear my efforts were not as successful as could be wished for.

The number of very important questions coming before this convention should receive your earnest and careful attention and deliberation.

The matter of plebicite vote on bi-annual conventions will be brought up for debate.

The report of the committee re bill for legislation is one we should consider well, as this will be the most important matter before us. I trust the committee will have this in detail, as each delegate will have to report to his own association, and it is essential that we keep right on and not give up until we have been successful in having the bill put through in every detail. I may say that within the last two months I have had three men who operate threshing engines inquire of me about certificates, and as to the method of how to go about to get them. This should be very encouraging, as it indicates that even in the rural sections engineers are considering the necessity of qualifying themselves for certificates.

You will see by the secretary's report that we are gaining ground. The old Association has been revised, and charters for new Association have been signed.

At your last convention I must say you made an excellent choice in your selection of a secretary in electing past-presiden Wickens to the office. In connection with the duties of this office a great amount of work is entailed, and Bro. Wickens has succeeded in keeping in touch with every officer of the executive, as well as each subordinate association.

The lesson papers which were in circulation last winter had the effect of bringing every member to think, and although some are old and scholarly men, there is yet something to learn and to teach. This feature in connection with our Association should be continued every winter, and even should some of the papers and lessons be repeated, there are always young men coming into the Association to whom such lessons would be a material help, as well as having the effect of perfecting ourselves in the different subjects taken up.

Yours fraternally,
ROBT. C. PETTIGREW,
President C.A.S.E.

On motion of Mr. Terry, seconded by Mr. Huggett, the president's address was received and referred to the committee on Good of the Order.

The committee on Credentials presented their report and were discharged. The minutes of the last meeting were read by the secretary and adopted.

SECRETARY'S REPORT.

Mr. Wickens, Secretary, submitted his report, which showed a membership of 239. It stated that a new association had been formed at Vancouver, B. C., and there was a good prospect of one at Sarnia. Ten associations had lapsed. Monthly papers, as ordered by the convention, were issued for five months, and had been of much benefit to the members. The legislative business for the year was strongly pushed by the joint committee of the Canadian and Ontario associations, and hopes are entertained of securing the desired legislation at the next session of the House. It was recommended to the convention that the actions of the Legislative Committee of the Brotherhood of Locomotive Engineers, in reference to the legislation asked for by the C.A S.E., be referred to a special committee, with instructions to endeavor to remove the opposition now being put forth by that body. The membership of the Association was shown to be as follows: Toronto No. 1, 124; Hamilton No. 2, 31; Brantford No. 4, 5; Dresden No. 8, 7; Berlin No. 9, 13; Brockville No. 15, 12; Waterloo No. 17, 11; Toronto No. 18, 38; Vancouver No. 19, 16; Calgary No. 1, 9 members—making a total of 266 members, a net gain (after deducting Montreal No. 1) of 27 members for the year.

The secretary's report was referred to the committee on Good of the Order. The report of the Treasurer, Mr. Moseley, showed a cash balance on hand of $202.18. Referred to the Auditing and Finance Committee.

Mr. Terry gave notice of motion that section 1, article 12, of the constitution, be amended by striking out the work "annual," and substituting "biennial," therefor. He also moved, seconded by Mr. Ames, that the present convention be concluded in two days. Carried.

Mr. Dixson gave notice of motion that in future the annual date of meeting be left in the hands of the executive committee, August, of course, being the month for such conventions. Referred to the Good of the Order Committee.

Adjournment was then made until 2.30 p.m. in the afternoon, when business was resumed. The reports of the committees on Mileage, Auditing and Finance were presented and adopted. The report of the committee on Good of the Order was read by Mr. Dixson, as follows:

REPORT OF COMMITTEE ON GOOD OF THE ORDER.

Clause 1.—Resolved, That the president's address was of a hopeful and congratulatoyr character, showing also a careful consideration of the manifold questions affecting the Association's interests.

Clause 2.—Resolved, That the executive secretary's report was complete in the details necessary for our development as an Association.

Clause 3.—Resolved, That C.A.S.E. membership, while not showing a great increase, had been held together firmly, largely by the individual efforts of the executive secretary. We wish to impress upon the members as a society that there are numbers of men in our profession who are eligible candidates for our society, who might be reached by making a united effort to secure them as members. We recommend further, that deputations be appointed from time to time to address mass meetings of engineers called for that end by the executive, who should be instructed to provide delegates and funds for such purposes.

Clause 4.—Resolved, That the Association, during its efforts to secure legislation at the last session of the House, was materially hindered by the opposition of a sister society, which issued a writtten protest unfavorable to our interests, and while we do not propose to deal with them in the spirit of retaliation, we are of the opinion that they must be laboring under an erroneous opinion to attempt to prevent us from obtaining legislation which would be of universal advantage. We desire to endorse our executive secretary's suggestion that a special committee be appointed to correspond with this sister organization with a view to enlightening them, and ultimately having this opposition removed, and their support obtained.

Clause 5.—Resolved, That the executive be instructed to issue a strongly worded circular prior to each half-yearly return made by secretaries of primary branches urging the necessity of making such returns punctually.

Mr. G. C. Mooring, President.

Clause 6.—Resolved, That the issue of the lesson papers be continued, as apart from their educational value they keep the members in touch with each other, and such cohesive value should not be overlooked. It is also recommended that the papers be mailed to secretaries of the primary branches for distribution.

Clause 7.—Resolved, That the month of August will in future be the month in which the annual convention is held, and we are of the opinion that the fixing of the day or days of the month to hold same shall be left to the decision of the executive.

Clause 8.—Resolved, That the changing of the convention from an annual to a bi-annual session would be detrimental to the growth of our society. The reasons are respectfully suumitted: First, that the organization will be in the course of time very wide in its influence. Second, that the yearly interchange of ideas is a great help. Third, that the bi-annual meeting would mean a lack of interest that would imperil the life of the association.

Clause 9.—Resolved, That the papers be issued to manufacturers and owners of steam plants, such papers to deal with questions, for example, as "Economy in Fuel," "General Saving Effected by the Supervision of a Competent Engineer," etc. We recommend that such papers be gotten up plainly and simply, and in such a general manner that they will impress not only the engineer, but the employer through whose hands they pass. We also recommend a grant of $50 to be used in this way.

Clause 10.—Resolved, That a continued effort be made, both by the Association and its individual members, to secure such legislation as would be in the best interests of not only the Association, but the public at large.

The above report was taken up clause by clause. Clauses 1 and 2 were adopted without discussion. Clause 3 resulted in considerable discussion, some of the members questioning the wisdom of the recommendation to send delegates to assist in organizing branch associations, inasmuch as a large expense might be incurred, but it was finally adopted upon the understanding that the member living nearest to the town or city should be sent. Clauses 4 and 5 were adopted as presented. Clause 6 brought up the question whether instruction papers should be mailed to the secretaries of the subordinate associations, or whether they should be mailed to each member direct. Mr. Wickens said that in order to place the papers in the hands of the members, it seemed necessary to send them direct. Mr. Huggett said that outside members complained of not getting their papers. Consideration of this clause was deferred until the following morning, and at 4 p.m. the delegates became the guests of the City Council Reception Committee and enjoyed a drive around the city, also visiting the refrigerating plant of the O'Keefe Brewing Company.

In the evening, a public meeting was held in the hall of Toronto No. 18, at which there was a large attendance. An address of welcome was delivered by Mr. T. Graham, president of Toronto No. 18. A paper on "Boiler Construction" was read by Mr. P. Trowern, engineer at the Toronto asylum. Considerable discussion followed, Mr. E. J. Philip taking exception in a friendly manner to some of the arguments advanced by Mr. Trowern. Mr. Wickens also spoke. A vote of thanks was tendered to Mr. Trowern for his paper.

An interesting paper on "Chimney Construction" was presented by Mr. E. J. Philip, chief engineer for the T. Eaton Cnmpany. Mr. Philip has just completed the construction for this company, of a chimney 186 feet in height, with 7-inch flues, and having a total weight of 1,400 tons. It is 16 feet diameter at bottom, and 9 feet 3 inches at top. The base is six feet of concrete. The paper will be published next month.

SECOND DAY.

Upon resuming business, the discussion on clause 6 of the report of Committee on Good of the Order was continued. Mr. Dixson was in favor of assessing a general tax on the members for the sending out of instruction papers. It was finally decided to continue the sending of papers to the subordinate lodges as heretofore. Clause 7 was adopted without amendment. Clause 8 aroused a lively discussion on the question of annual or biennial conventions. A motion by Mr. Terry, seconded by Mr. Webb, that the clause be strcuk out, was lost. Mr. Terry spoke very strongly in favor of a convention every two years, contending that the money thus saved could be expended to better advantage for educational purposes. Mr. Moseley sngested doing away with the the annual banquet, which would reduce the expenses and encourage small associations to hold the annual convention in their towns. The clause in favor of annual conventions was finally carried by a good majority. Clause 9 recommended the sending of engineering papers to steam users. Mr. Moseley moved, seconded by Mr. Terry, that the clause be struck out. Lost. Mr. Mooring moved an amendment that the sum of $50 be voted for the purpose, to be used in conjunction with a grant from the Ontario Association. Carried. Clause 10 was adopted, and on motion of Mr. Dixson, seconded by Mr. Ames, the report of the committee, as emended, was adopted.

Mr. Chas. Moseley, Vice-President.

On motion of Mr. Moseley, Messrs. Dixson, Wickens, Huggett, Webb, Mooring, Dawson, and the mover were appointed a committee on legislation. The convention then adjourned to visit the plants of the

Toronto Street Railway Company and the Toronto Electric Light Company.

A committee was appointed to interview the Canadian Manufacturers' Association, to explain that the C.A.S.E. is an educational body, and that the legislation which is asked for is for the purpose of inducing users of steam power to employ properly qualified engineers.

At 3 p.m. the election of officers was proceeded with, the result being as follows: President, G. C. Mooring, Toronto; vice-president, Chas. Moseley, Toronto; Secretary, A. M. Wickens, Toronto; treasurer, Wm, Oelschlager, Berlin; conductor, Geo. Dawson, Hamilton; doorkeeper, John M. Dixson, Toronto. Votes of thanks were tendered to the scrutineers, Messrs. Trowern, Chapman, and Amber, and the installation of officers was then proceeded with.

It was decided to hold the next convention in the city of Brantford.

The usual grant was made to the secretary.

The retiring president, Mr. Pettigrew, was made the recipient of a past master's jewel. Votes of thanks were then tendered to the city council, the retiring officers, and the mechanical press.

On motion of Mr. Pettigrew, the secretary was instructed to send a letter of greeting to the Canadian Electrical Association in session at Kingston.

THE BANQUET.

The annual banquet was held at Webb's parlors on the evening of the 29th ultimo, Mr. Huggett, president Toronto No. 1, officiating as chairman. After welcoming the guests, the secretary read letters of regret from Mr. Carscallen, M.P.P., Hamilton; J. F. Ellis, president Canadian Manufacturers' Association; J. R. Barber, M. P., Georgetown; F. R. Latchford, M.P.P.; the Mayor, Ald. Loudon, and others. After the edibles had been disposed of, the toast list received attention. "The Queen" was duly honored. With the toast "Ontario, the Garden of Canada" was coupled the name of Thomas Crawford, M.P.P. He said he recognized the C.A.S.E. as a good society, and had had the pleasure at one time to introduce a bill for the engineers, which, however, did not pass the House. Last year Mr. Carscallen had introduced a similar bill, and he thought results should be attained within a year or two. The legislation asked for was important. From the number of lives depending on the competency of the engineer, it became imperative that legislation should provide that he should be qualified for the position in which he was placed. To the toast "Toronto, the Queen City," Ald. Urquhart and Graham responded. Both recognized the usefulness of the C. A. S.E., and were in sympathy with their movement towards securing legislation. Messrs. Mooring and Moseley responded to "The Executive Council." The latter dwelt on the necessity of educating steam users to employ only competent engineers. In Toronto, he said, thirty-eight boilers were under the sidewalk, and it was absolutely necessary that they should be in charge of competent men. He knew of old boilers that had been taken out of second-hand shops and bricked up, but were totally unsafe. Mr. E.J. Philip was also asked to respond. He said that many thought that the object of the proposed legislation was to make the Association a closed corporation to advance wages, but this was entirely wrong. The public would be the principal gainers, and steam users would be benefitted by having their plants operated more economically. To the toast "Our Guests" Messrs. Steeper, Oelschlager and Pettigrew respoded. The latter pointed out that the Association was not an enemy to the manufacturer. He hoped that other corporations would soon follow the example of Hamilton city council and employ only engineers holding certificates. "Our Rights and Wrongs" brought responses from Messrs. Wickens, Dixon and Main. Mr. Dixon made a most eloquent and humorous speech, which was heartily applauded. Toronto No. 1 was then toasted, and proceedings ended by singing "God Save the Queen." During the evening Blea's orchestra rendered a first-class programme of selections, and there were songs by Messrs. W. J. Lawrence, D. C. McGregor, H. B. Short and E. Piggott.

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SPARKS.

Mr. Hartley Gisborne, E.E., has resigned his position with the Crow's Nest Pass Coal Company, to accept a more lucrative appointment on Vancouver Island.

Mr. A. Harrington, of Shallow Lake, recently passed the examination of the Ontario Association of Engineers, and is now taking a course with the International Correspondence Schools, of Scranton, Pa.

The Vernon & Nelson Telephone Company has just secured a contract from the Miner-Graves Smelter people for the construction of a 30-mile metallic circuit private telephone system between Greenwood and Grand Forks, B.C.

Mr. W. T. Steward, E. E., of Toronto, has just finished, on behalf of the town of Oshawa, in arranging an amicable settlement with the present electric lighting company of that place, for a renewal of the contract for lighting for a term of five years.

W. Moore & Sons, of Meaford, have just installed a Thomson light alternator, in addition to the 500 light alternator and 35 light arc machine which have been in operation up to the present time. They expect to still further increase their plant in the near future by the addition of a large power plant, in order to meet the wants of the increased demand in their town.

The prices of scholarship in the International Correspondence Schools, Scranton, Pa., will be increased on October first. Before that date new students will have the benefit of the lower prices, in force at the time of enrolling. Even at the new prices, the scholarships are remarkably low, and the terms of payment are liberal. Payment may be made in either \$2, \$3 or \$5 installments, or a discount will be given to students paying in advance.

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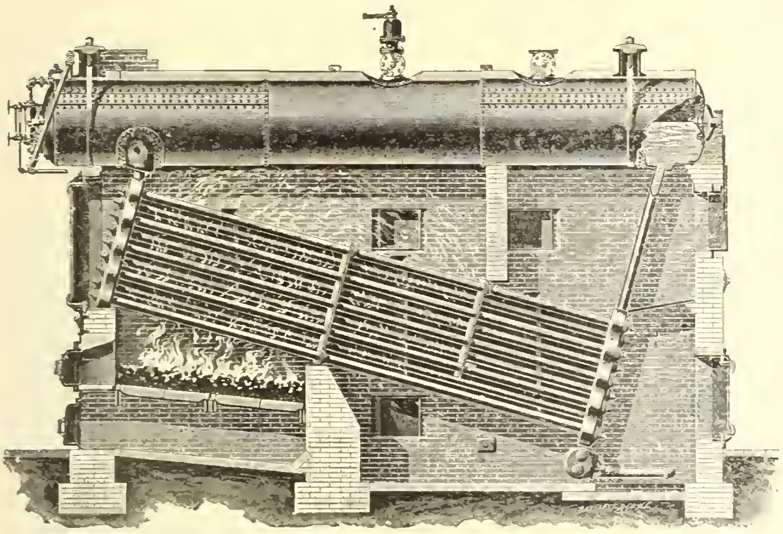

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SPARKS.

Mr. W. H. Birchard has made an offer to the Royal Electric Company to purchase the electric light plant at Aurora, Ont.

The town council of Thessalon, Ont., have adopted a motion to consider the advisability of installing a civic electric light plant.

The city of Halifax, N.S., is looking into the question of street lighting. The Halifax Electric Tramway Company have agreed to make a new contract to supply 236 arc lamps at $65 per lamp per annum, and a number of 50 c.p. Bernstein lamps for lighting the city building at $21 per lamp per annum.

The arbitration to fix the value of the electric light plant of the Pembroke Electric Light Company, which the town of Pembroke desires to purchase, is in progress as we go to press. The arbitrators are Judge Mosgrove, of Ottawa, for the town, Judge Valin, of North Bay, for the company, and these two have agreed upon Judge Senkler, of Perth, as the third arbitrator. The Pembroke Electric Light Company have engaged as experts Mr. David Starr, E.E., of Montreal, and Mr. J.J. Ashworth, manager of the General Engineering Company, of Toronto, while the interests of the town are in the hands of Mr. Roderick J. Parke, E.E., of Toronto, and Robt. A. Ross, E.E., of Montreal.

Ambitious mechanics who desire to obtain better positions and higher wages should investigate the many advantages afforded by the correspondence method of instruction in the theory of the trades and engineering professions. Without leaving home, or losing time from work, the student pursues a thorough course of study under the direction of able instructors, who are always ready and willing to assist him. Instruction papers, prepared especially for teaching by mail, are furnished free. These papers, written in clear and concise language, as free as possible from technicalities, are much superior to ordinary text-books on the subjects of which they treat. In addition, special information regarding any difficulties in their studies is furnished students without extra charge. It should be the ambition of every man to advance in his trade or profession. A mechanic with practical experience supplemented by theoretical education can command a better position than a man without such an education. The result of long experience in teaching by mail shows that no other method so fully meets the requirements of men who have but little time for study.

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SPARKS.

It has been rumored that the Ottawa Electric Railway Company contemplate extending their line from Rockliffe Range to Besserer Grove.

At a recent meeting of the city council of Picton, Ont., the question of installing a municipal electric light plant was given some consideration.

The Selkirk Electric Railway Company have met with considerable success in securing franchise privileges from the various municipalities along the route of their proposed road from Winnipeg to Selkirk. The overhead trolley system is to be adopted.

The ELECTRICAL NEWS acknowledges receipt of an invitation to be present at the twenty-second annual Rhode Island Clam Dinner tendered to the electrical fraternity by Mr. Eugene F. Phillips, manager of the American Electrical Works, of Providence, R. I. The event takes place on the 13th inst.

The corporation of East Toronto is making satisfactory progress with the installation of its municipal electric light plant. The contract for electrical apparatus has been awarded to the Canadian General Electric Company, and tenders invited for the erection of power house. Mr. H. F. Stricland is consulting engineer.

Among the exhibitors in the machinery hall at the Toronto Exhibition was the Steam Specialty Company, of 43 Wellington street east, Toronto. This company are sole agents in Canada for the Bundy steam specialties, including traps, separators, feed water heaters, etc. The Bundy return steam trap attracted considerable attention. By its use the condensed water from all apparatus using live or exhaust steam is returned to the boiler, thus affecting a saving in fuel. The Steam Specialty Company are also agents for the Manzel automatic oil pump. They are now represented on the road by Mr. J. W. Marr, late chief engineer for the Metropolitan Railway Company.

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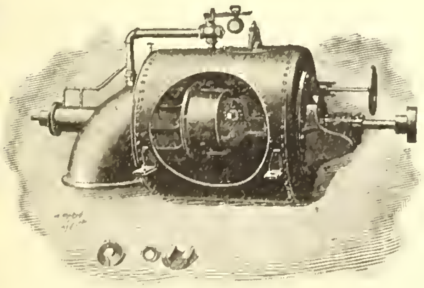

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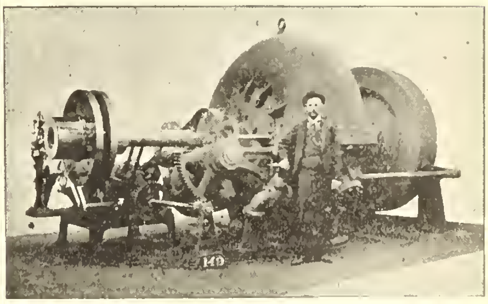

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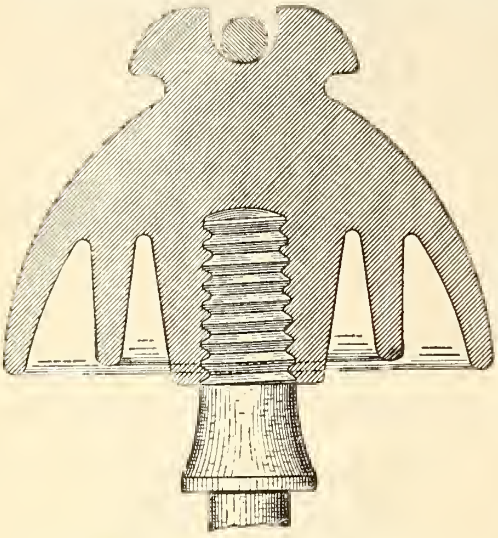
SPARKS.

The corporation of St. Louis, Que., is being sued by the Citizens' Light & Power Company, of Montreal, for $3,325 for electric light supplies.

The Calgary Water Power Company, of Calgary, N.W.T., have offered to supply the city with 35 1,200 c.p. arc lights for street lighting at $65 each per annum, on a five year contract. They also agree to erect new poles, and to install new enclosed arc lamps.

The village council of Huntingdon, Que., have accepted the tender of Boyd & Company to operate electric light and water-works systems. The company agree to install a dynamo of a capacity of 1,000 16 c.p. lamps, and to have the works in operation by January, 1901.



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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N. Y. Evening Post, Oct. 9, 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival; the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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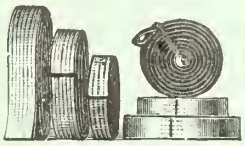

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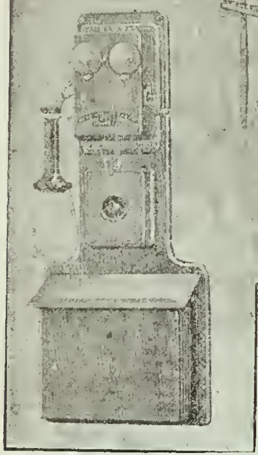

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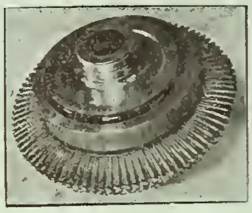

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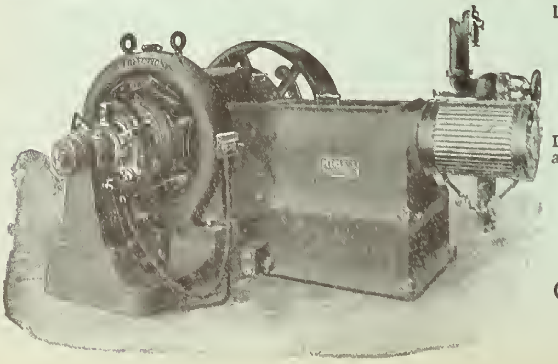

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OCTOBER, 1900

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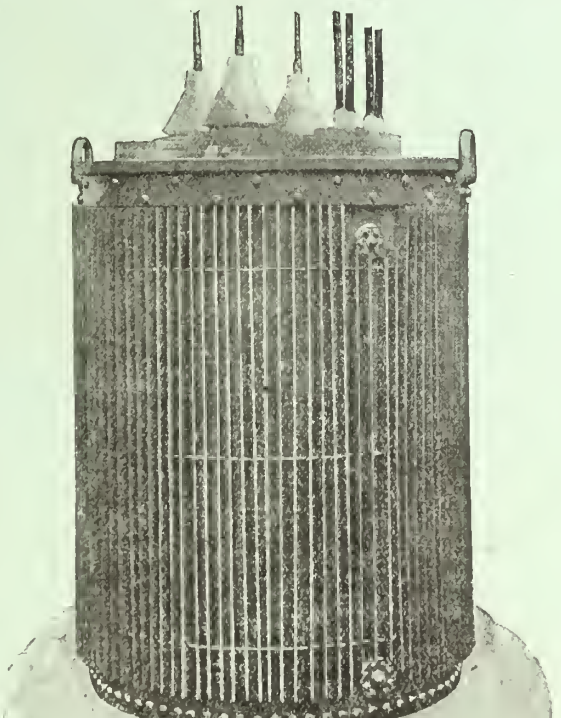

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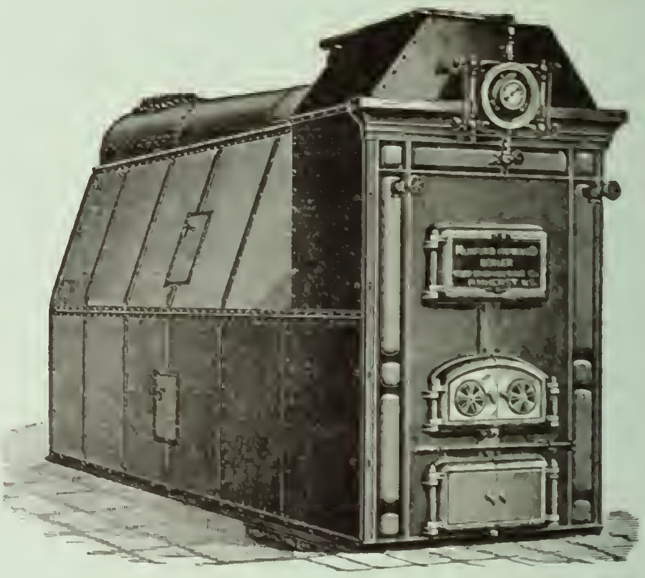

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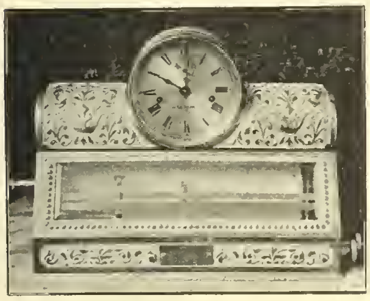

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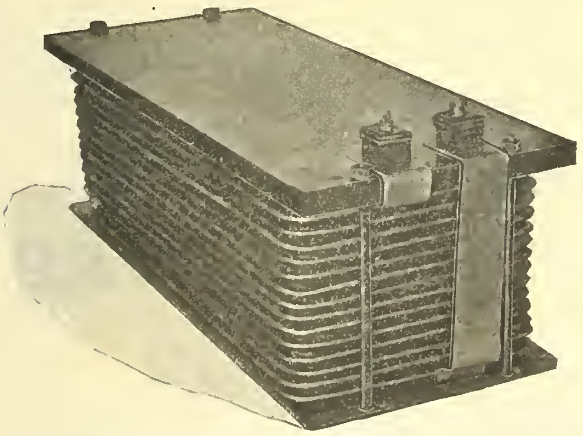

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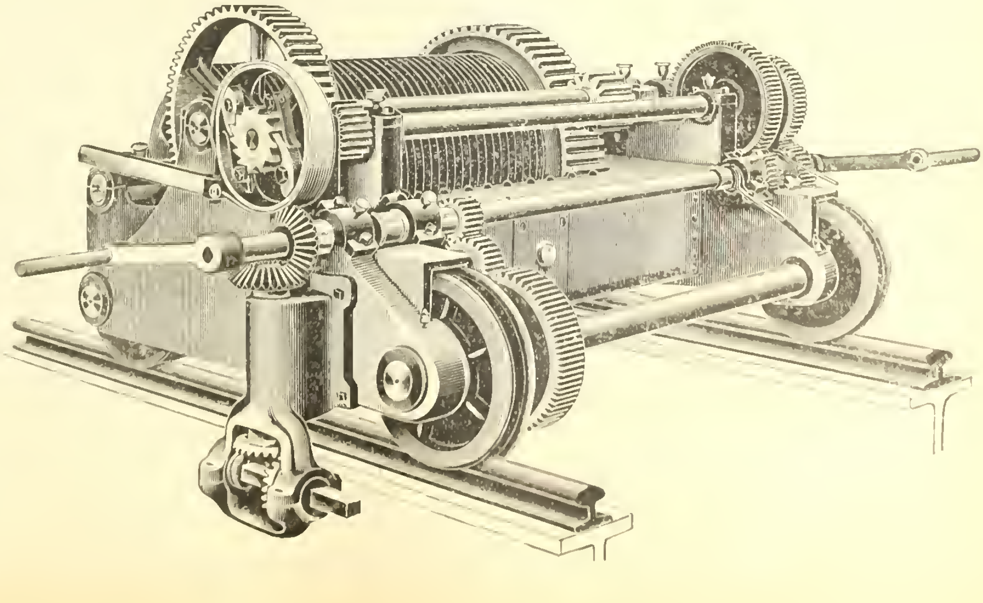

SPARKS.

The Bellechasse Telephone Company recently started operations in Levis, Que.

The New Brunswick Telephone Company, of Fredericton, has increased its capital stock to $250,000.

The City Council of Kingston, Ont., is making arrangements to take over the electric light and gas plants.

It is stated that the contract is about to be awarded for the construction of the Canadian-Australian Pacific cable.

It is expected that telegraphic communication with Dawson City, in the Yukon district, will be established this month.

The Dominion Government has just taken tenders on the construction of a telegraph line from Golden to Windermere, B. C.

The new electric light plant for the village of Hespeler, Ont., is expected to be in operation early in November. The contract for engine and boiler was let to the Goldie & McCulloch Company, of Galt, and that for electrical apparatus to the Canadian General Electric Company, of Toronto.

The Renfrew Electric Company, of which Mr. A. A. Wright is president, are building a new power house and developing all water power recently secured from Mr. Hough. The water wheel will be of the horizontal Crocker type, and the new dynamo of the most improved design. The new plant is expected to be in operation early in November.

The newly incorporated Western Telephone & Telegraph Company, of British Columbia, intends to build lines through the Nelson and Slocan districts and to connect the boundary country with the coast and Vancouver. The lines of the company will be operated in connection with those of the Columbia Telephone Company.

Sweden, of all the countries of Europe, is perhaps most blessed with natural power. From the mountain streams at the head of every fiord a quantity of energy is available, the total being enormous. To this fact the Swedes are rapidly waking up, and imports of electrical machinery for utilization of these water powers are growing with rapid increments.

Water powers have been developed as a result of the general introduction of electricity until there are now 500 of these electric plants in the United States, representing an investment of over $60,000,000 and a capacity of 200,000 horse power. Current thus generated is furnished for lighting 28,000 arc lights, 845,000 incandescent lights, and for operating about 60,000 horse power of motors. There are over 610 miles of electric street railways operated by water power electrically transmitted.

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month.	Light.		Extinguish.		No. of Hours.
		H.M.		H.M.	H.M.
1....	P.M.	9.50	A.M.	5.00	7.10
2....	"	10.50	"	5.00	6.10
4....	"	0.00	"	5.00	5.00
5....	A.M.	1.10	"	5.00	3.50
6....	"	2.30	"	5.00	2.30
7....	No Light.		No Light.		.... .
8....	No Light.		No Light.		.....
9....	No Light.		No Light.		.....
10....	No Light.		No Light.		.....
11....	P.M.	5.50	P.M.	9.00	3.10
12....	"	5.50	"	10.00	4.10
13....	"	5.50	"	11.00	5.10
14....	"	5.50	"	0.00	6.10
15....	"	5.50	A.M.	1.00	7.10
16....	"	5.50	"	2.00	8.10
17 ...	"	5.50	"	3.00	9.10
18....	"	5.40	"	4.00	10.20
19....	"	5.40	"	5.00	11.20
20....	"	5.40	"	5.30	11.50
21....	"	5.40	"	5.30	11.50
22....	"	5.40	"	5.30	11.50
23....	"	5.40	"	5.30	11.50
24....	"	5.30	"	5.30	12.00
25....	"	5.30	"	5.30	12.00
26....	"	5.30	"	5.30	12.00
27....	"	5.30	"	5.30	12.00
28....	"	7.30	"	5.30	10.00
29....	"	8.30	"	5.30	9.00
30....	"	9.40	"	5.30	7.50
31....	"	10.40	"	5.30	6.50
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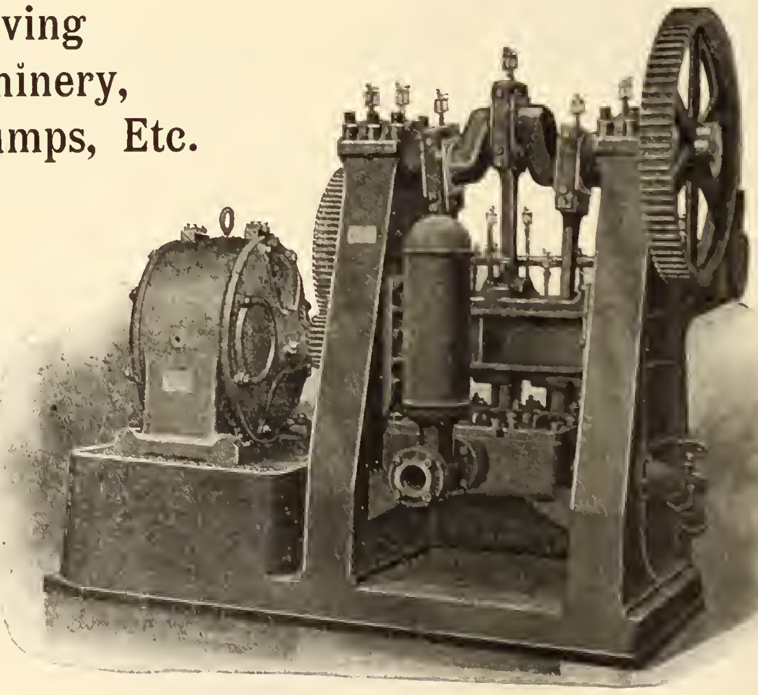

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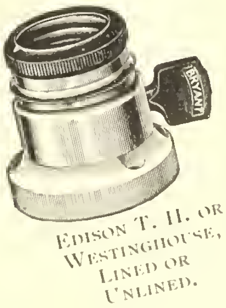

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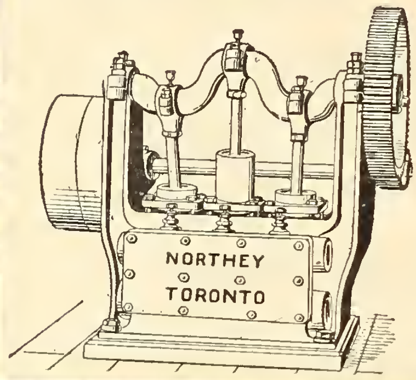

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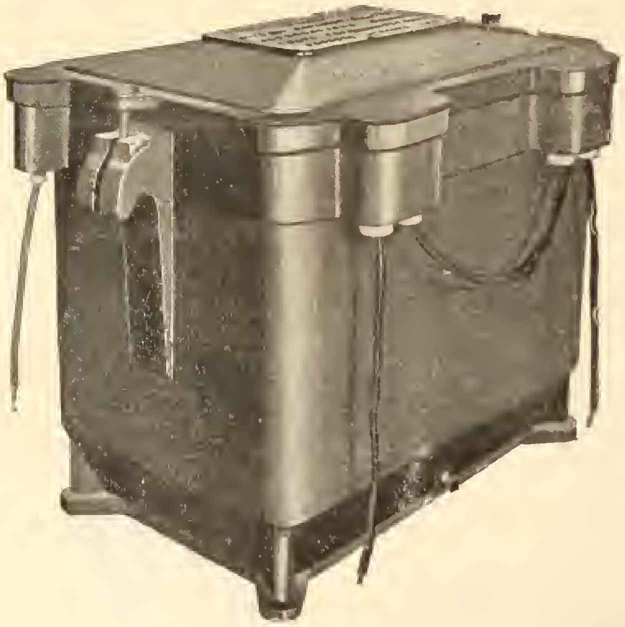

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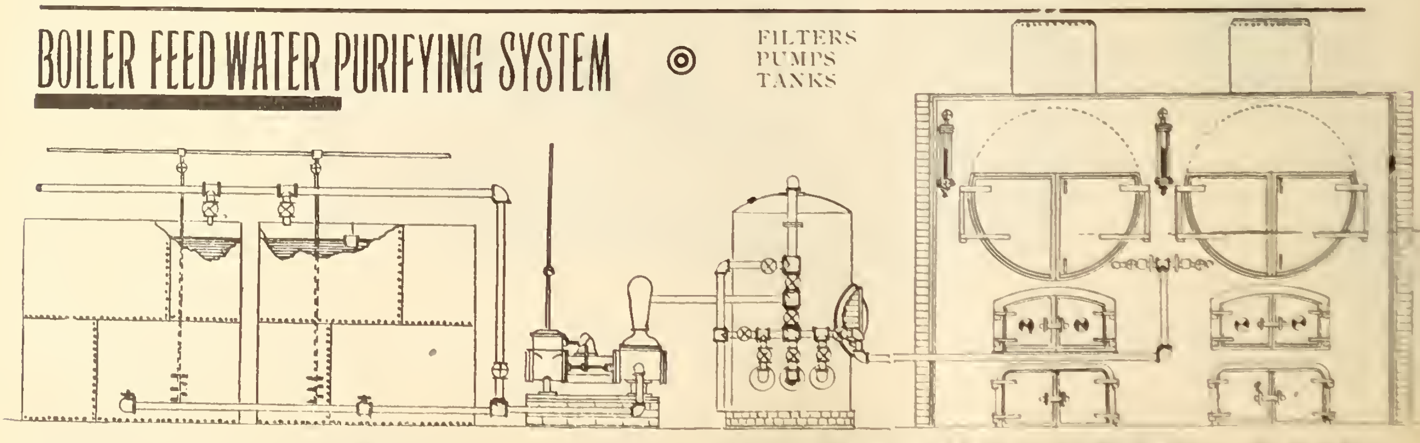

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CANADIAN
ELECTRICAL NEWS
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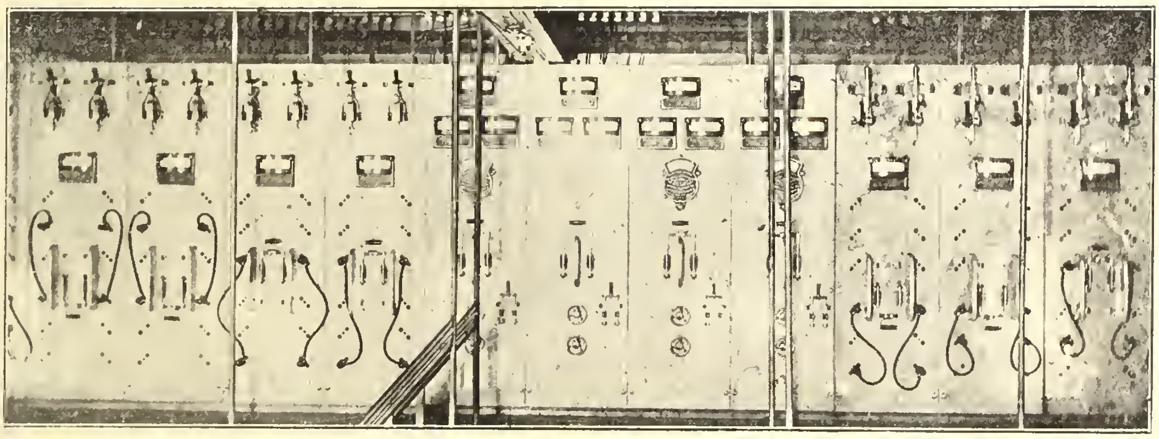
ENGINEERING JOURNAL.

VOL. X. OCTOBER, 1900 NO. 10.

A MODERN SWITCH-BOARD.

THERE has recently been installed in the station of the London Electric Company, at London, Ont., a sixteen panel switch-board for controlling the alternating output of their plant, which is a splendid example of modern switch-board construction, containing, as it does, the latest ideas obtaining in this class of work, and being adapted to control not only the present output of the station, but also that for some years to come.

The present alternating generating equipment of the station consists of two 300 k.w. revolving field and two 120 k.w. revolving armature, single phase, belt driven alternators, all manufactured in the Peterborough shops of the Canadian General Electric Company. The engines driving the first two generators are vertical, simple, non-condensing, designed for this plant by Messrs. E. Leonard & Sons, of London, the 120 k.w. generators being at present driven by the "Peerless" type, manufactured by the same firm.

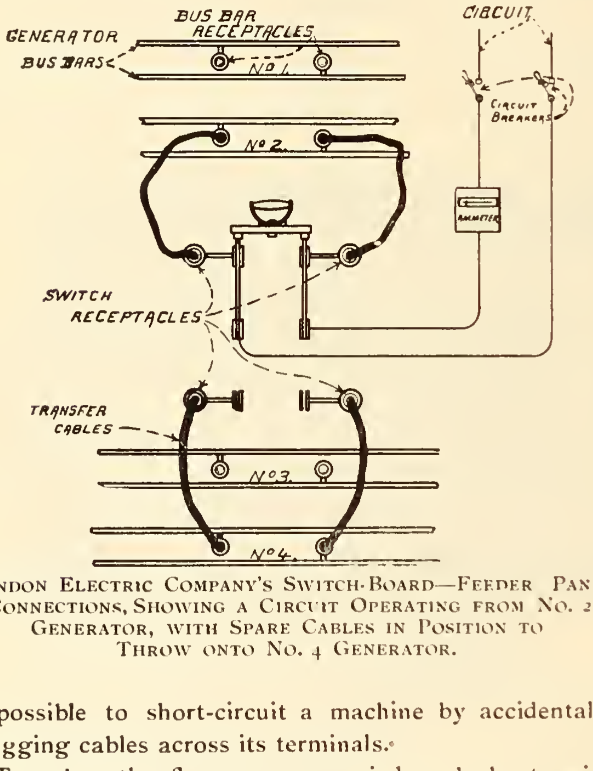

SWITCH-BOARD IN LONDON ELECTRIC COMPANY'S POWER HOUSE, LONDON, ONT.

As it is intended that the generator equipment of the plant shall always be four units, the sizes being varied as the output increases, there are four generator panels provided, each capable of controlling a 300 k.w. generator and containing the usual equipment of main ammeter, voltmeter, exciter ammeter, generator switch, ground detector, field switch, and rheostats. Each panel is 80 inches high and 24 inches wide, a size very well adapted to give a pleasing and convenient distribution of the necessary apparatus, and being, for boards similar to this, much preferable to the usual arrangement of a shorter panel mounted on a sub-base. The material is polished blue Vermont marble, adopted on account of its high insulating resistance, and also because it makes a very effective background for the instruments, which are of the Wagner Company's make, finished in dull black and with scales calibrated to suit the particular load on each meter, the voltmeters reading from 90 to 130 volts, which arrangement obviously gives a clear open and easily read scale. The ground detectors are of the Canadian General Electric Company's usual static type, giving a continuous indication of the state of the insulation of all the lines throughout the city.

The generator switches are double pole, single throw and quick break, adapted to handle their rated current without destructive arcing. They are provided with marble barriers between the blades to prevent any chance of short-circuiting a generator when opening its switch, the handles being of the spade type. The field switches have a second set of jaws in addition to those usually provided, which put a resistance in parallel with the fields when the circuit is being opened, so as to take the inductive discharge. There are no fuses, the circuit breakers on the various feeders being relied on to take care of any line short-circuits.

The feeder panels, twelve in number, of which ten only are at present installed, the balance being added as occasion requires, are placed five on each side of the generator panels, and are of the same height as those for the generators, namely, eighty inches, three of them being twenty-four inches wide and the balance twenty inches. Each panel contains two single pole I. T. E. circuit breakers, mounted, as shown by the illustration, directly on the marble, one ammeter, and, as it was not deemed advisable, for a number of reasons, to parallel the generators, there is provided on each feeder panel one double pole, double throw, quick break switch, with barriers and transfer cables, for expeditiously changing the various circuits from one machine to another, the method of operation being as follows:

The centre studs of this switch are connected each to one of the outgoing feeder wires of a circuit, the two bottom and two top studs being each connected to a flush mounted plug receptacle. On the back of the board, from end to end, are run eight generator bus-bars, a pair for each machine, each being tapped on each feeder panel to a receptacle similar to that on the switch blades. Now, if any pair of these receptacles be connected by means of cables with suitable plug terminals to either the upper or lower pair of switch receptacles, and the switch thrown onto that pair of jaws, it is evident that that feeder will be connected to that generator in whose bus-bar receptacles the cable plugs were placed, and that the other jaws of the switch will be entirely disconnected. This being so, they can, by means of a spare pair of cables, be connected to any other generator bus-bars desired, and if the switch be thrown the other way the circuit will then be transferred to that generator without interruption to the continuity of the service other than the two or three seconds occupied in throwing the switch. The receptacles connected to the switch jaws with their plugs, being larger than those for the bus-bars, it is obviously impossible to short-circuit a machine by accidentally plugging cables across its terminals.



London Electric Company's Switch-Board—Feeder Panel Connections, Showing a Circuit Operating from No. 2 Generator, with Spare Cables in Position to Throw onto No. 4 Generator.

To reduce the floor space occupied, and also to give the attendant a clear view of all the machines under his control, the board is mounted on a platform, suspended from the roof timbers by the iron rods shown in the cut, about 12 feet above the floor, access being obtained by stairs, the landing of which is shown in the illustration. It has been in use sufficiently long to thoroughly show its suitability for the service desired, and is now in daily operation, handling the station in a highly satisfactory manner, and demonstrating the many advantages of a well-designed and modern switch-board over the numerous and various complications of old switches and wiring net-works too often found doing duty even at the present day, and which are not only fruitful sources of interruptions to the service, and often of fires, but are also a constant menace to the safety of those handling them.

The Belgo-Canadian Pulp & Paper Corporation, which purposes establishing pulp and paper mills at Shawinigan Falls, Que., have contracted with the Shawinigan Power Company for 15,000 h. p. of water. The works of the Pittsburg Reduction Company at the above place are nearing completion.

BY THE WAY.

A fat man who was holding on to a strap in a crowded Philadelphia street car was precipitated into the lap of a lady passenger by the car suddenly rounding a curve. The lady brought an action for damages against the company, for injuries sustained and the jury, after hearing the evidence of the medical witnesses, awarded her $2,300. Street railway companies cannot afford to let the fat men stand, however they may disregard the comfort of the thin ones.

× × ×

At the creation of the world two great lights were made, the greater light to rule the day, and the lesser light to rule the night. But there is no night for the lesser light to rule in the Yukon at present. A correspondent writing from Fort Selkirk on the 29th ultimo, writes: "It is now 11 p. m. and I can see to write without a candle. We have daylight twenty-three hours of the twenty-four." It is somewhat confusing to contemplate this nightless, night-capless, nightmareless existence in the golden north, and we find ourselves unable to determine whether its manifest advantages would counter-balance its disadvantages if such conditions of everlasting light prevailed in Montreal at this season of the year. It might lessen the work of the City Recorder, but it would certainly reduce the revenue of the gas and electric light companies.—Insurance Chronicle.

× × ×

A gentleman who recently returned from Sault Ste. Marie has told me something about the wonderful progress which that town is making, and which is in a large measure due to the ability and enterprise of Mr. Clergue, manager of the great pulp mills. This gentleman, who, by the way, is a bachelor, lives in a house of the block house type, and on the site where a block-house once stood. The first story of the building is constructed of local red sandstone, and the upper stories of logs or square timbers. Another peculiarity of this residence is that the heating, lighting and cooking are all done by electricity. The proprietor being also the owner of the electrical plant from which the streets and industries of the town are lighted, and of the immense water power by which the electricity is generated, is in a position to adopt this method of heating, the expense of which would be prohibitive in the case of persons less fortunately circumstanced. Speaking of power I am reminded that Mr. Clergue is now developing by means of canals on the Canadian side 80,000 horse power, and on the American side 100,000 horse power.

× × ×

The old saying that many a true word is spoken in jest finds an admirable illustration in a quotation from "Punch" of December 30th, 1848, which is published in the London Electrical Engineer. The quotation, which foreshadows the telephone in a remarkable manner, is as follows: "Our attention has been directed to an article made of gutta percha called the telakouphanon, or speaking trumpet, a contrivance by which it is stated that a clergyman having three livings might preach the same sermon in three different churches at the same time. Thus, also, it would be in the power of Mr. Lumley, during the approaching of the holiday time, to bring home the opera to every lady's drawing room in London. Let him cause to be constructed at the back of Her Majesty's theatre an apparatus on the principle of the ear of Dionysius, care having been taken to render it a good ear for music. Next, having obtained an

Act of Farliament for the purpose, let him lay down, after the manner of pipes, a number of telakouphanon, connected (the reader will excuse the apparent vulgarism) with this ear, and extended to the dwellings of all such as may be willing to pay for the accommodation. In this way our domestic establishments might be served with the liquid notes of Jenny Lind as easily as they are with soft water, and could be supplied with music as readily as they can with gas."

× × ×

I HAD a funny experience when I first went to Canada," said a well-known telephone engineer who is operating a large exchange in the Province of Quebec. "As you know, Quebec is the headquarters of the French-Canadian, and in the eastern part of the Province there are many people who speak no English ; in fact, there are whole towns full of them. One day I had to go on important business to a little town which we call Ste. Therese. When I found my man there I found also that he could neither speak nor understand English, nor did I at that time know a word of the peculiar lingo that the 'habitant' calls French. What to do I did not know, as no interpreter could be found, and finally, in desparation, I called up the Montreal office and asked for somebody who knew both languages. He came to the telephone, and I told him what I wanted to say to my French friend ; he repeated it to him over the telephone, received the reply and translated it for me into English. In this way we maintained a satisfactory conversation for about half an hour, the interpreter being a good many miles distant from the two men for whom he was rendering his services. I do not know when the telephone has ever been put to a test like this before to show what a polyglot instrument it is."

SPARKLESS MAGNET COILS.

By James Asher.

It is the purpose of the writer to describe several simple methods of winding eleetro-magnets in order that sparking at the contact maker may be either entirely suppressed or greatly diminished. The first method and the fourth are my own ; the rest, are not generally known.

It is well-known that when the ordinary winding on an electro-magnet is used furious sparking occurs at the contact maker at each break of the circuit. Sparks are generated also at each close of the circuit, but these sparks are comparatively small. Sparking at the contact maker is due to the currents of self-induction, or extra currents in the wire which is wound round the core of the electro-magnet. At closing the circuits these currents oppose the current from the battery, but at breaking the circuit they flow in the same direction as the current from the battery. These extra currents are of considerable tension. The powerful sparking injures the contacts of the contact maker.

First Method.—Two insulated wires of the same kind and length are wound as one strand on the bobbin throughout their entire length. The two ends of one of these wires are firmly fastened together. The two ends of the other wire are connected with the contact maker and the battery in the usual manner. The extra currents in the winding which is connected with the battery are completely annihilated by the induced currents which are generated at their expense in the closed winding, which is similar and similarly situated to the winding which is connected with the battery. Hence we have no sparking at the contact maker.

Second Method.—This was invented by Carlier. It consists in winding the bobbin with bare copper wire, and separating each layer from the next by the thickness of paper. When currents of electricity having low voltage are employed, the lateral contacts of the coils of wire are sufficiently imperfect to prevent much loss of current from the battery by direct flow from coil to coil, while they easily allow the lateral passage of the extra currents, which are always of comparatively high tension. These become self-cancelled in passing through the coils of bare copper wire. Du Moncel states that this method is very effective, and he expresses his surprise that it has not been more frequently employed. Perhaps if the wire were dipped into very thin varnish before winding it upon the bobbin, we might use the magnet in connection with a battery capable of generating an electric current of high voltage.

Third Method.—The magnet has two separate windings of the same length and of the same kind of wire. These two wires should be wound together as one strand on the bobbin throughout their whole length. The two ends of one wire are fastened to the terminals of the battery, consequently there is a closed circuit during the whole time of operating the electro-magnet. The two ends of the other wire are connected with a circuit closer and the battery in the ordinary manner. The connections of the two wires are made in such a manner that the current in the winding connected with the contact maker flows round the core in the opposite direction to that of the current in the other winding, which is unconnected with the contact maker. The two equal currents, passing round the core in opposite directions, fail to develop magnetism in the iron core of the electro-magnet. On opening the circuit of either of these wires the core instantly becomes magnetic. The effect on the core is directly opposite to that in the common method. We get absolutely no spark whatever at the contact maker, either at break or at close of circuit, according to Professor Silvanus P. Thompson.

Fourth Method.—Two insulated wires of the same kind and of the same length are wound together as one strand on the bobbin. The first two ends of the wire are fastened to a wire which extends to one binding screw of the battery. The last two ends of the wires are fastened to a wire which extends by way of the contact maker to the other binding screw of the same battery. The extra currents in the two windings at breaking circuit are neutralized by their mutual reactions.

Fifth Method.—This was invented by Billet, and described by Du Moncel in his book which is entitled "Electricity as a Motive Power." Each leg of the magnet has two bobbins of wire. The two ends of wire at the middle of each leg of the electro-magnet are joined to the two ends of wire at the middle of the other leg of the electro-magnet. The other two ends of wire on one core are connected with one terminal of the battery and the two corresponding ends of wire on the other core are connected with the other terminal of the same battery. A contact maker is interposed. The extra currents at breaking circuit are suppressed by their mutual inductive reactions. The extra currents at closing circuit, however, are not destroyed by this method. Consequently a small spark appears at closing circuit.

Sixth Method.—This was invented in England by W. Langdon-Davies. Each wire is wound as only one layer and the ends are allowed to slightly project. After all the layers have been wound the separate ends on one bobbin of the electro-magnet are joined to a wire which constitutes one terminal of a battery, while the separate ends of the wire on the other bobbin are joined to a wire which constitutes the other terminal of the same battery. On interrupting the current in either terminal the sparking is found to be weaker than usually is the case. The extra currents in the different layers of wire are not quite simultaneous, because the layers are at different distances from the core.

Seventh Method.—This was invented by an American named Paine. After winding each layer of wire round the bobbin a sheet of tinfoil is wrapped round the layer. At breaking and at closing circuit the extra currents in the wire induce currents in the sheets of tinfoil. In consequence, sparking at the contact maker at each break and at each close of circuit is greatly diminished.

Eighth Method.—A sheet of copper is wrapped round the bobbin before the wire if wound on. At breaking circuit induced currents are generated in the copper sheath. The sparking at breaking circuit is considerably weakened. Currents are generated also in the sheath at closing circuit. The sparking at closing circuit is weaker than usual. This method is believed to have been either invented or adopted by Mr. Charles F. Brush, of Cleveland, O.

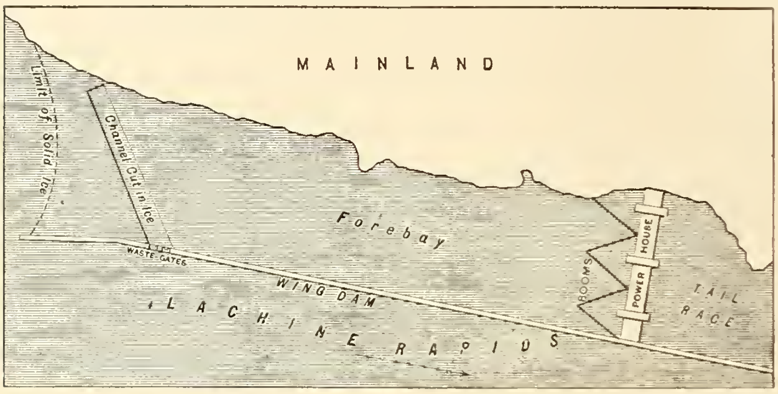
The Miner-Graves Syndicate have under consideration a project to transmit electric power from Grand Forks to Phoenix, B. C.

The city engineer of Toronto has submitted to the city council estimates of the cost of installing and operating a telephone system. For 6,000 subscribers he places the cost of installation at $675,000, and the annual cost of operating, including depreciation at five per cent. and interest at 3½ per cent., at $120,000. For a system for 10,000 subscribers the cost of installation is given as $1,120,000, and annual cost of operating $205,000. These estimates are based upon a common battery switch-board.

THE LACHINE RAPIDS ELECTRICAL TRANSMISSION PLANT.

In the ELECTRICAL NEWS of October, 1897, there appeared a general description of the electrical power plant of the Lachine Rapids Hydraulic & Land Company, of Montreal, then nearing completion. Since that time some improvements have been made, and we are now enabled to present to our readers a description in greater detail, which will doubtless be of interest.

HYDRAULIC DEVELOPMENT.—The St. Lawrence river is divided by a long, narrow island at a point above the city of Montreal into two channels. The two streams taken together are known as the Lachine Rapids, and it is in the northern of the two streams that the power development has been made. Parallel with the shore there has been erected a wing dam 5,200 feet long, of cribwork composed of 12 in. x 12 in. timbers, faced with three inch plank and filled with rock. Between this dam and the shore the distance is 1,000 feet, and across the canal thus formed is built a solid masonry dam upon which is located the power house. The tail race is 1,400 feet wide, and the forebay or upper part of the channel about 4,000 feet long, 1,000 feet wide and 13 feet deep, the velocity of the water through it being two feet per second. There is a system of booms so arranged that all rubbish is carried away by the three waste gates in the main dam. The general situation may be understood by referring to the accompanying map. The total available fall varies up to about 16 feet.



SKETCH MAP, SHOWING LIMIT OF FREEZING IN THE LACHINE RAPIDS FOREBAY.

FRAZIL ICE.—The difficulties from frazil and anchor ice were in a large degree overcome by having a large enclosed area of still water, which would freeze over early in the winter, making it impossible for frazil or anchor ice to form under such cover. Frazil ice formed in the rapids above the enclosed area of still water. This obstacle was met by the fact that the natural current of the river, varying from 15 to 20 feet per second, would be deflected into the open river on meeting the frozen surface and would carry all frazil along with it. But during the winter of 1897-98 trouble was experienced from both frazil and backwater. The cause of the frazil ice was the previously unknown existence of a reef which projected past the wing dam and against which the frazil, in being swept onward with the current, adhered, producing anchor ice. This formed a natural dam, throwing the frazil into the head race instead of carrying it into the open channel beyond. During last year improvements were made which are said to have eliminated all further troubles from anchor ice. The wing dam was raised and extended a distance of 1,000 feet, thus enclosing a greater body of water. A pier was also erected some 7,000 feet above the power house, projecting 1,000 feet from the river bank, thereby diverting the original course of the river and causing it to flow towards the main channel and away from the head race. In addition, sluices have been left in the wing dam which, should occasion require it, may be used for ridding the head race of any anchor ice that may be forced into it when the river above is completely blocked with ice. To overcome the trouble from backwater the tail race was extended and deepened and an extension made to the wing dam.

THE POWER HOUSE.—The power house is a steel building 1,000 feet long by 40 feet wide, and consists of three dynamo rooms 65 x 45 feet, and a similar number of turbine sheds. The floor is of concrete with 1½ inch slate, the whole being supported by steel beams. The building is heated electrically, each room being supplied with coil heaters.

TURBINES.—The hydraulic equipment consists of 72 54-inch Victor turbines, vertical, cylinder-gate type, capable of developing, under 14-foot head, about 300 h.p. Under the low head of 8 feet the wheels will develop 135 h.p. They are set in flumes, the wheels resting on wooden floors communicating with the tail race by means of short steel draft tubes. The wheels are set in sets of six in two rows, all six of each set driving by bevelled gearing a single shaft, which is direct coupled to the revolving field of one of the dynamos. A single governor controls the gates of all six wheels, the driving being accomplished by means of a wooden tooth gear on the wheel shafts meshing with cast iron pinions on the horizontal line shaft which runs to the dynamo. Two types of governors are used, the Giessler electro-mechanical governor, built by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, and the Lombard governor, manufactured by the Lombard Water Wheel Governor Company, of Boston, Mass. Iron head gates are placed at the entrance to cut off the water supply in case of necessity, and iron racks prevent debris and floating matter from being drawn into the wheels. An ingenious system of signals is used between the switchboard and the governor station in the wheel rooms, the invention of Mr. R. S. Kelsch, superintendent of the plant. When a machine is being brought into circuit signals are exchanged by means of colored lamps between the control table in front of the switchboard and the wheel station, these signals being wired in such a way that a signal must always be repeated back to the senders before it can be obeyed.

THE GENERATORS, ETC.—Each battery of six wheels is direct coupled to a generator of the three-phase type, manufactured by the Canadian General Electric Company. There are 12 generators in all, with revolving fields, forty poles, giving 750 kilowatts at 175 r.p.m. They are wound to deliver 99 amperes with a frequency of 60 cycles per second at 4,400 volts directly to the transmission lines, no interposition of step-up transformers being needed. The winding is of the usual wire coiled type and is ranged in one slot per pole per phase. Each generator is direct connected to its jack-shaft. All of the field coils are connected together in series. The exciters consist of six Canadian General Electric machines, four polar, 75 k.w., 150 volt, direct current, compound wound, operated at 660 r.p.m. Each pair of exciters is driven by an independently governed water wheel. The wheel used for this purpose is one of the six 300 h.p. wheels for operating the generators, the last wheel of the series having been detached from the generator shaft and belted to one exciter. Each exciter is sufficient to operate the whole four machines in the dynamo room.

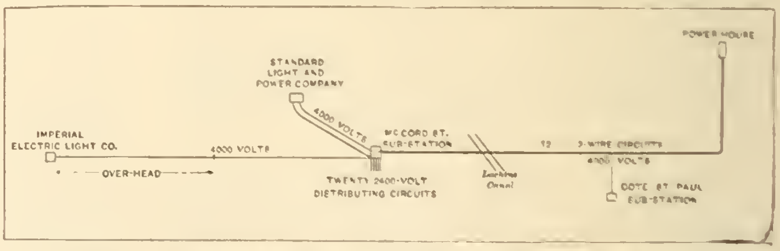


DIAGRAM OF TRANSMISSION AND DISTRIBUTION CIRCUITS FROM LACHINE RAPIDS POWER HOUSE AND IN MONTREAL.

THE SWITCH-BOARDS.—The switch-board as at present installed contains seven panels, each 36x52 inches, with sub-panels, 28x36 inches, all mounted on slabs of blue Vermont marble two inches thick. The two outer panels, one at each end, are for light and power, there being two separate sets of bus-bars for this purpose insulated with heavy rubber and tested to 10,000 volts. These panels each contain three ammeters, a direct reading voltmeter, three single blade, double-throw, quick-break, high tension line switches, and two static ground protectors. The next two panels on each side are for the four generators, and each contains three synchronizing lamps, two ammeters and a field switch. The center panel controls the exciter and contains three Weston ammeters, a voltmeter, two alternating voltmeters, and two triple-pole, double-throw switches. All high tension fuses are situated on the back of the board and near the top, so that in case of a fuse blowing no damage is done either to the board and apparatus or to the attendant. The back of the board is interesting. The bus-bars are of copper cable covered with hard rubber tubing and caps. There are two sets of these bars, and any machine may be thrown upon either at will, as may any of the transmission circuits to the city. In this way practically any combination of machine and circuit can be made. Situated in front of the switch-board is a marble table on which are placed the signalling apparatus by which the switch-board attendant can give or receive any signal necessary between the switch-board and the turbine shed. The regulating device consists of the four field rheostat handles, the exciter rheostats, the synchronizing switch and the four switches for operating the emergency switches of the oil type, worked by compressed air and placed one in each generator lead in the basement below the switch-board. The lightning arresters are of the Wirt 5,000 volt type, connected in delta between the three phases. It is understood that it is the intention of the company to replace the present switch-board with one of more elaborate construction and design.

The Pole Line.—From the power house a line 32,000 feet long is laid to the main distributing station at the corner of McCord and Basin streets, in the city of Montreal. It consists of 12 three-phase lines of No. 0. B. & S. bare copper wire, mounted on triple petticoat porcelain insulators carried on 4x4 inch wooden cross-arms, on steel poles. These poles are of latticed iron, 35 feet long, imbedded six feet in concrete, foundation 2x3 feet, and spaced 100 feet apart. The line drop is 14 per cent. of full load. The twelve lines are all operated in parallel, though they can be subdivided in any way desired. When the corporation limits are reached the wires are placed undergound. They converge into a paper covered lead armored cable, one circuit in each, the insulation being 7-32 inch, and tested to withstand 15,00 volts. They cross ten feet below the bed of the Lachine canal, and 33 feet below the water level, in three inch cement lined iron pipes, of which there are 24, and thence to the sub-station not far distant. At an intermediate point a short line branches off to the Cote St. Paul sub-station.

The Sub-Stations.—The main sub-station, corner McCord and Seminary streets, is a two-story brick structure. From the underground conduit running into the basement of this building, the transmission line passes to the high tension switch-board, and after passing through the aluminum line fuse it reaches the high tension switches, then the step-down transformers, of which there are three of 150 k. w., and four of 250 k. w., of the self-cooling oil type, one of the latter being in reserve. By these the voltage is reduced from 4,000 to 2,400. There are also three transformers of 30 k. w. each, of the self-cooling oil type, used as boosters. The transformers were built by the Wagner Electric Manufacturing Company, of St. Louis. In the Cote St. Paul station the equipment consists of Manning boilers, Westinghouse engines, two Walker and two General Electric synchronous motors, usually to operate three 125 arc light Wood machines, which are at present run from the jack shaft in the power house to light the streets of Westmount, one of the western suburbs of Montreal.

Distribution.—The method of distribution will be understood by reference to the accompanying diagram. From the main sub-station the primary distribution is carried over the entire city in underground conduits containing from 8 to 63 ducts of 3-inch cement lined iron pipe, in which three phase wires varying from No. 3 to 0000 B. & S. are placed, each in a paper insulated lead armored cable manufactured by the National Conduit & Cable Company, of New York. The manholes in the street are each covered with a heavy iron cover. Ventilation is maintained by running pipes to the street pole. Cables are carried above ground from the conduits for the ordinary overhead distribution to feed areas of half a mile radius. The main sub-station supplies twenty 2,400 volt distributing circuits throughout the city, and also supplies one 4,000 volt circuit to the Imperial & Electric Power Company's station in the eastern end of the city, where the current is used to operate synchronous motors driving the electric light machinery, and two circuits to the station of the Standard Electric Light & Power Company, where one is transformed to operate two rotary converters feeding a 500 volt, three wire, direct current motor circuit in the business portion of the city, while the other operates a synchronous motor for driving arc lighting and other dynamos. These 4,000 volt lines are tested at the sub-station through two sets of 30 kilowatts transformers in parallel with one another, but in series with the line. On account of the extensive nature of the city, and the many trees it contains, the secondary net work is of unusual size. It is maintained at 110 volts, and small induction motors are fed at this pressure, the larger ones generally employing the 2,000 volts current of the intermediate distribution.

Reserve.—To provide for accidents, the company have installed at the Cote St. Paul and Chenneville streets sub-stations a reserve steam plant which will be brought into use in case the water power plant is compelled from any cause to close down.

The Load.—The load on the company's system is about 75,000 incandescent lamps, and between 2,500 and 3,000 horse power in motors, both synchronous and induction. The rate for lighting is ¾ of a cent per sixteen c. p. lamp-hour, with a discount of 20 per cent. for prompt payment. For large consumers under contract the rate is reduced to ½ cent per lamp hour; this corresponds to 9.4 and 7.8 cents per k. w. hour respectively, four watt lamps being used. The rate for power varies from $85 per horse power per year to $32 per horse power for large machines.

THE REASON WHY SOME BELTS DO NOT GIVE BETTER SATISFACTION.

By E. H. Newton.

We often hear this or that particular brand of belting condemned because it did not give satisfaction. Some men prefer leather for all purposes, while others are partial to some other kind. If we study the conditions under which one belt will work better and last longer than another, we will find that most belts are good if the proper judgment was exercised in their selection for the work they are intended to do. The fact that a leather belt will not last in a damp place or where it is exposed to wet is no reason why the use of leather belting should be discouraged, for under favorable conditions there is nothing better than a good leather belt. On the other hand, if a rubber belt has been run where oil got on it, destroying its good qualities, or the edge has been allowed to rub against something until it is worn through, allowing the belt to separate, or, as is too often the case, the belt is too light for the work and a gum or resinous substance is used to make it stick to the pulley—under such conditions good results will never follow, for I know of no better way to destroy the life of a rubber belt than to use oil or gum on it. I have seen the rubber peel clean off the inside of belts and stick to the pulleys by the use of resin and oil. In many mills incompetence does more to destroy the belt than the work if it was properly adjusted and cared for.

I once knew a man to use up five leather belts in succession in one season, where water was allowed to get on them. The next season a rubber belt was put on the same place and covered so that it was kept dry, and at the end of the season it was nearly as good as new. Had this precaution been taken when the first leather belt was put on, the result would have been equally satisfactory.

Much care should be exercised in selecting belts heavy enough to transmit sufficient power without being run too tight. If a wide belt cannot be used and a narrow one is not able to do the work, increase the diameter of the pulleys proportionately and you will overcome the difficulty. When a thick belt is run at high speed over a very small pulley with unfavorable results, if a wider and thinner belt cannot be used, increase the pulleys also, and note the improvement.

The lacing has quite a lot to do with the life of a belt, as when a belt is not properly laced the holes soon tear out, destroying the belt. I lace in three different ways for three different kinds of belt, namely, very thick, medium to thin, and cross belts. Thick belts, being usually run on large pulleys, work well with the straight lace. Thin belts on smaller pulleys work best with what I call the interwoven lace, as laced in this way the holes never tear out. But for a cross belt, rubber or leather, I prefer the lacing known as the "boot-leg," as the lace cannot wear when the belt rubs together, and laced in this way any cross belt will work well.

A company has been formed at New Denver, B. C., to light the villages of New Denver and Silverton by electricity.

According to the coroner's jury, an electric shock, due to a defective transformer, caused the death of Mr. H. B. Davidson, manager of the electric company at Selkirk, Man. The verdict concludes: "We are of the opinion that to avoid contact with the ground by any person or persons, that floors of the electric station should be insulated in the pump rooms and around the dynamos and switchboards, and that vulcanized sockets only be used in damp places, all machinery duly safeguarded by railings and other protection, and that for the protection of the public, a government inspector of electric light and power houses should be appointed, and all electric appliances tested."

EXHIBITS AT THE C. E. A. CONVENTION.

We publish in this number two views of the principal exhibit at the convention of the Canadian Electrical Association held recently in Kingston. This is the first year in which exhibits were made under the auspices of the Association. Unfortunately, when it was decided that an exhibit of electrical apparatus should form a feature of the convention, the time was very limited for manufacturers to prepare their exhibits, and a number who intended to exhibit, and no doubt will in the future do justice to their apparatus and supplies, were prevented on account of the season of the year from making an exhibit.

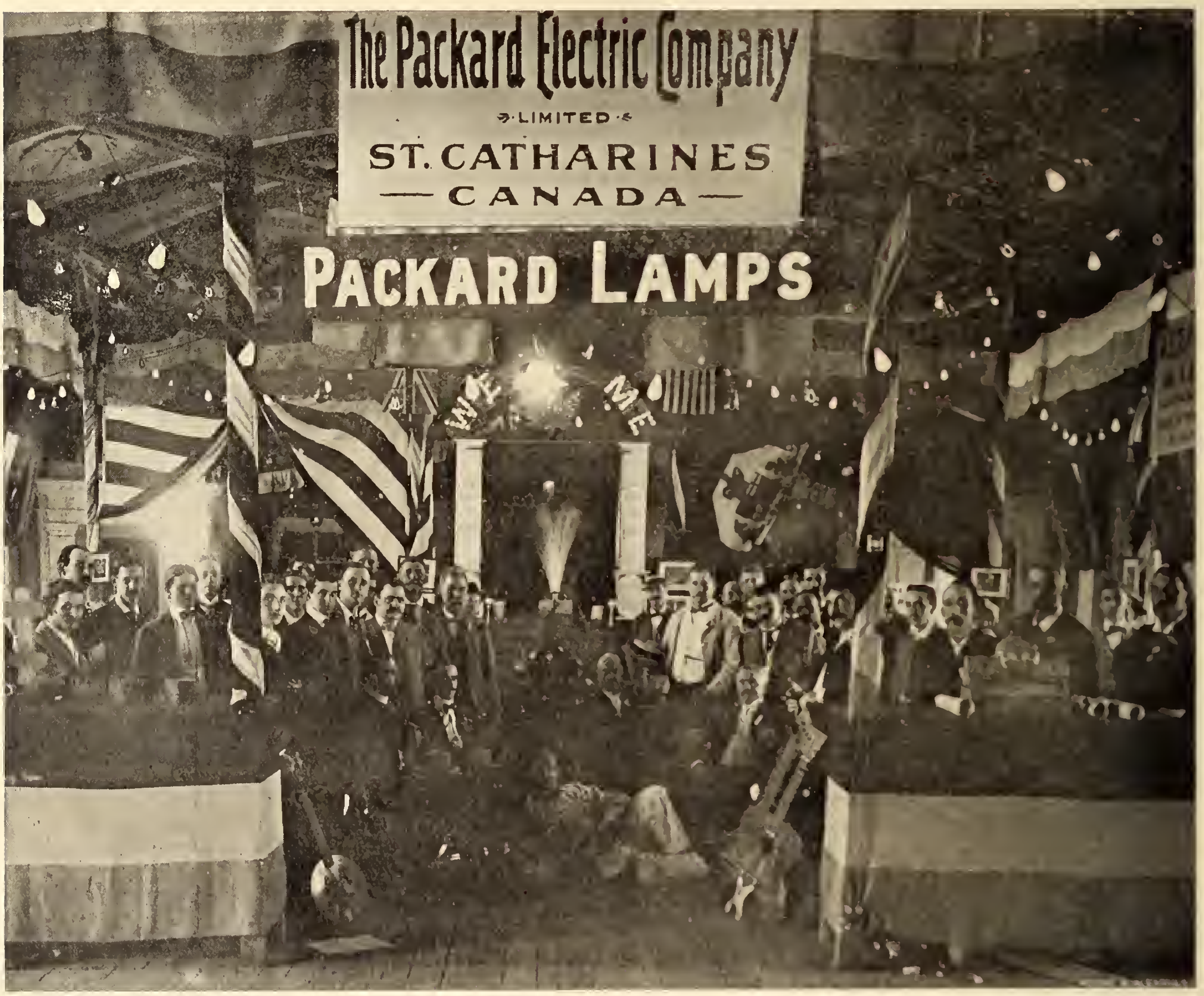


Exhibit of The Packard Electric Company at Canadian Electrical Association Convention, Kingston, 1900.

The Packard Electric Company, of St. Catharines, made a special effort, and in conjunction with their allied interests, consisting of Mr. R. E. T. Pringle, of Montreal, The C. P. Company, of St. Catharines, and the Hamilton Electric Supply & Construction Co., of Hamilton, had a handsome exhibit of the various apparatus and supplies made and sold by them. The exhibit, as shown in the illustrations, was arranged in a square 30 feet x 30 feet, with four entrances, the centre of each side. Uprights at the entrances and at each corner extended 18 feet above the floor. From the entrances to each corner there was a broad counter upon which various detailed supplies, coils of transformers, and meters, were exhibited. Within the exhibit were several summer couches, easy chairs, and various kinds of refreshments for the inner man. In the centre of the exhibit was a fountain eight feet in diameter at the base, the spray being ten feet above the floor. This was strictly an electric fountain of the rustic type, which, together with the plants and vines by which it was surrounded and covered, produced a very artistic effect, as underneath the water shone the radiance of 100 green lamps.

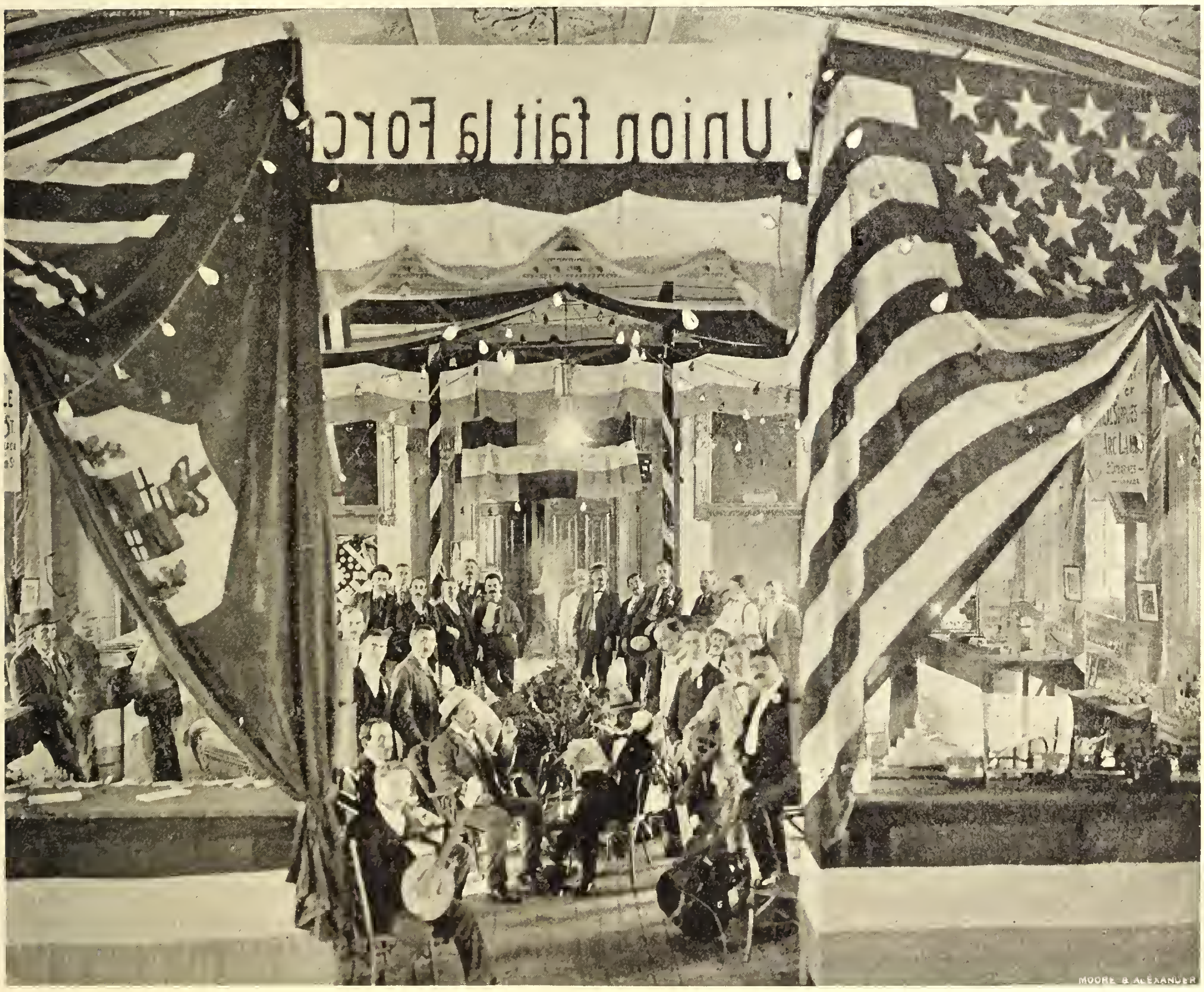
Probably the most interesting part of the exhibit was that of the new type "E" Scheeffer recording watt-meter for alternating current. This exhibit involved a number of instruments and was so arranged that an inductive and non-inductive load could be thrown instantly upon the meter which was being tested. Upon inductive loads, by means of a Stillwell regulator, the power factor could be varied from .30 to .90. Then the same load in watts upon incandescent lamps could be thrown upon the meter and readings taken. The meter was of small capacity, being the 10 ampere, and notwithstanding the small size involved, the results by actual test showed the meter to be correct within one-half of one per cent. upon the two loads with the varying power factor, as above stated. Several managers of prominent central stations in Canada took pleasure in making personal readings, and apparently the type "E" Scheeffer watt-meter solves the question of accuracy upon inductive and non-inductive loads, which has been carefully experimented with and sought for by several of the larger makers during the past two years. Doubtless other prominent makers have succeeded in accomplishing the same results, but this was the first actual test in Canada exhibited to the assembled fraternity.

Upon another counter was exhibited the flat, or pancake type of coil, which the Packard Company now use exclusively in all sizes of their transformers from 1.5 k.w. to 150 k.w.

The C. P. Company exhibited various supplies of a hundred and odd varieties which they are now manufacturing in the works of the Packard Company at St. Catharines.

Arc lamps, both series and for direct current, and multiple lamps for direct and alternating current, were exhibited also by the C. P. Company.

In addition to the exhibit of the above mentioned companies, Mr. Frank Martin, of the Hamilton Electric Light & Cataract Power Co., exhibited his register for central stations, which registers the current in amperes upon a chart, by which can be readily calculated the total energy of the output of a central station for 24 hours. These charts are very interesting; the register is very ingenious and doubtless will become in popular use.



MOORE & ALEXANDER

EXHIBIT OF THE PACKARD ELECTRIC COMPANY AT CANADIAN ELECTRICAL ASSOCIATION CONVENTION, KINGSTON, 1900.

A new enclosed magnetic type of lamp invented by Messrs. Martin & Stuart, of Hamilton, was exhibited, and one illuminated the interior of the exhibit, being placed directly above the fountain. Bunting and flags of Great Britain and the United States were plentifully used and lent an artistic appearance to the whole exhibit. Two large flags, one being the Union Jack and one Old Glory, were entertwined in the rear of the exhibit as one entered it through the main entrance of the City Hall, and between them was a banner with the motto "L'Union fait la force." Over 500 incandescent lamps illuminated the exhibit at all times.

NEW APPOINTMENTS AT THE KINGSTON SCHOOL OF MINING.

SEVERAL new appointments have recently been made in the Kingston School of Mining. Mr. L. W. Gill, B. A. Sc., has been appointed to the new chair of electrical and mechanical engineering. Professor Gill is a distinguished graduate of McGill University. After graduation he studied for two years as Exhibition Research Scholar, and had the distinguished honor of being offered the Scholarship for a third year. This scholarship is of the annual value of 150 pounds sterling, and is awarded by Her Majesty's Commissioners from funds remaining from the receipts of the Exhibition of 1851. Mr. Gill's work as research scholar was carried on partly at McGill and partly at Harvard University. Since the completion of this work he has been in the employ of the Westinghouse Company, Pittsburg.

Dr. John Waddell, B. A. Sc., Ph.D., has been appointed lecturer on Industrial Chemistry, and Mr. C. R. McInnes that in Applied Mathematics.

Mr. A. G. Burrows, M.A., has been appointed demonstrator in Mineralogy, and M. B. Baker, B. A., in Geology.

The Mining Laboratory has been rebuilt so as to give twice the space for machinery and a lecture room and testing laboratory. The Carruthers Science Hall has been improved by the addition of a ventilating system, controlled by fans, for removing the foul air and replacing it with pure warm air.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal

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The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Governmental Management of Telegraphs.

SINCE 1870 the control and management of the British telegraph system has been vested in the government. The effectiveness of the service seems to leave little ground for complaint, but from a financial point of view the results are entirely unsatisfactory and calculated to make other countries think twice before adopting the system. While the system was being conducted as a private enterprise it paid dividends of 8 to 14 per cent. Since the government assumed control, however, there have been large deficits almost every year. The shortage last year on a total business of three and a quarter million pounds amounted to more than half a million pounds. The aggregate of these yearly deficits has now reached seven and three-quarter million pounds. The astonishing feature of the case is the fact that the volume of business and receipts has largely increased.

Electricity vs. Gas.

AN interesting paper on the above subject was recently presented by Mr. White, of Cincinnati, before the Ohio Electric Light Association. The figures which he gives prove conclusively the advantages of electricity over gas for street illumination. He showed that in about 60 per cent. of the cities of over 25,000 inhabitants in the United States gas had been entirely discarded in favor of electricity for street lighting purposes. In the other 40 per cent of the cities electricity is used to a greater or less extent and is steadily growing in favor. In only one city has electricity been replaced by gas, and it is said that the explanation of this bears a close relation to the politics of the city. The figures regarding the economy of the two kinds of illumination are particularly timely, and show that electric light is the cheaper. The cost in Chicago, from official figures, is $784.60 for gas lighting per mile and $567.45 for electricity, while the brightness of illumination of the latter is much superior to that of the former. Mr. White submitted the statement that one arc of 800 actual useful candle power will give as much light as 20 Welsbachs of 40 candle power.

Employment of Incompetent Attendants

THE employment of persons incompetent to perform the duties expected of them is an evil which exists, perhaps, in a greater or less degree, in every branch of industry, and is therefore not altogether foreign to the electrical business. The claim has been made that the manufacturing companies are encouraging the employment of incompetent workmen as engine and dynamo tenders. The severe competition that is encountered and the desire to effect a sale is apt to induce salesmen to lead thier customers to underestimate the cost of attendance necessary for the successful and economical operation of apparatus. A certain firm in Toronto who are the owners of an isolated electric light plant are said to have engaged to operate the plant a cheap and inexperienced engineer. The mistake thus made was soon discovered and a competent engineer substituted. It has been stated that the builders of the engine were responsible for the employment of the first engineer, because they understated to the owner the amount of skill and attention that the plant would require. The necessity is apparent that manufacturers of electrical and steam apparatus should guard against having the reputation of their goods suffer as the result of inexperienced attendance. Cheap labor around an electrical or steam plant invariably means that the saving effected in salaries will be more than offset by excessive operating expenses.

Effect of Snow on Telephone Wires.

Experiments to determine the effect of snow on telephone wires have recently been made by Mr. E. Pierard, a telegraph engineer of Belgium, the results of which are interesting. He found that a bronze wire 2 mm. in diameter collected an ovoid of snow, whose two axes were respectively 28 mm. and 36 mm. The weight of the snow was, roughly, 1.78 times that of the wire. A smaller wire 1.4 mm. in diameter collected an envelope of snow 4.38 times its own weight. The result of this snow collecting on the wires running from the central office in Brussels imposed an extra weight of over 30 tons on the supports. In calculating the deflections produced by the heavy coats of snow the author found that in many cases the long spans were safer than short ones. This was because the long spans sagged sufficiently to enable the central portions to find additional supports on house ridges, etc. As an example of what these sags would be with the weights mentioned above, the author found that with a syan of 100 yards there was a sag of four yards, with a span of 550 yards the sag was about 25 yards.

Electric Lighting Statistics.

At the annual convention of the National Association of Officials of Bureaus of Labor Statistics of the United States, held in Albany in June, 1896, a committee was appointed to undertake an investigation of the private and municipal ownership of water, gas and electric light plants. This committee recently submitted the results of its investigations, which are published as the fourteenth annual report of the Commissioner of Labor. The general impression is that one of the main objects of the report was to prove the advantage of municipal as compared with private ownership. There seems no reason for dissatisfaction so far as the abundance of information in the report is concerned, it being perhaps quite as complete as could be expected, considering the many difficulties met with in gathering information of this character. It is equally true that the results neither prove nor disprove the claim that municipal ownership is more economical than private management. Neither is it difficult to discern that the compilers of the report were partial to municipal ownership, hence their statements should, in our opinion, be discounted. We will not attempt to make deductions from the numerous tables bearing upon the cost and operation of electric light plants, this being well nigh an impossibility, but some of the figures given in the introduction and analysis of the tables are of peculiar interest. It is shown that in the United States there are 965 gas plants, of which but 14 are under municipal control. The number of electric light plants is 3,032, of which 460 are municipal and 2,572 private. The report covers 320 municipal and 632 electric light plants, or about 35 per cent. of the total number in the United States. The capacity of the electric lighting plants has been given by taking the rate of horse power of the engines as the basis. It is noticeable that municipal ownership is most common in respect to small plants. Of those of 50 h. p. investigated by the committee, 9 were municipal and 6 private ; of 100 to 125 h. p., 13 were municipal, and 10 private ; 200 to 300 h. p., 14 municipal, 19 private ; 500 to 750 h.p., 7 municipal, 57 private ; 1,000 to 1,500 h. p., 4 municipal, 34 private ; while of 5,000 h.p. plants, none are owned by municipalities, and 15 by private interests. This is also shown by the invested capital, 320 municipal plants representing an investment of $10,908,925, and 632 private plants an investment of $113,917,815. The cost of producing electric light is gone into at some length. In this one of the largest items is, of course, the salaries and wages account. This is divided into two sections, that of salary including the remuneration to officers, superintendents, clerks, etc., and that of wages being the amount paid for engineers, firemen, dynamo tenders, linemen, and like help. In seven of the groups shown the average cost for wages exceeds that in the private plants, while in eight of the groups this item in the private plants is greater than in those municipally controlled. On the other hand, the average cost for salaries in municipal plants is smaller in every instance than in private plants, in some cases being less than one-half. This is, indeed, a strange anomaly, and somewhat contradictory. It is in calculations of this sort that the advocates of municipal ownership find ground on which to base their so-called arguments. Municipal electric light systems are frequently operated as an adjunct to other plants, making it possible for those so inclined to charge an unjust proportion to the cost of operation.

ANCHOR ICE AND ELECTRICITY.

A novel use has been found for an electrical stove by the Water Board of Marquette, Mich. The stove has been put in the intake pipe which supplies the water to the city works from Lake Superior, and its purpose is to keep anchor or needle ice from forming on the sides of the pipe and finally stopping the flow. The stove is the invention of the superintendent of the local electrical plant. It is a resistance coil like those used for heating street cars, and is made in circular form to fit within the intake pipe, the water passing through it. Current is furnished to the stove at slightly above one hundred volts, and the plan is to keep it in constant operation when weather conditions are favorable for the formation of needle ice. It is not necessary that any great quantity of heat should be generated, a rise of two or three degrees being sufficient to melt the ice as fast as it forms. The cost of the apparatus is $25, and this expenditure will save at least $100,000 for a new and deeper intake.—N. Y. Evening Post.

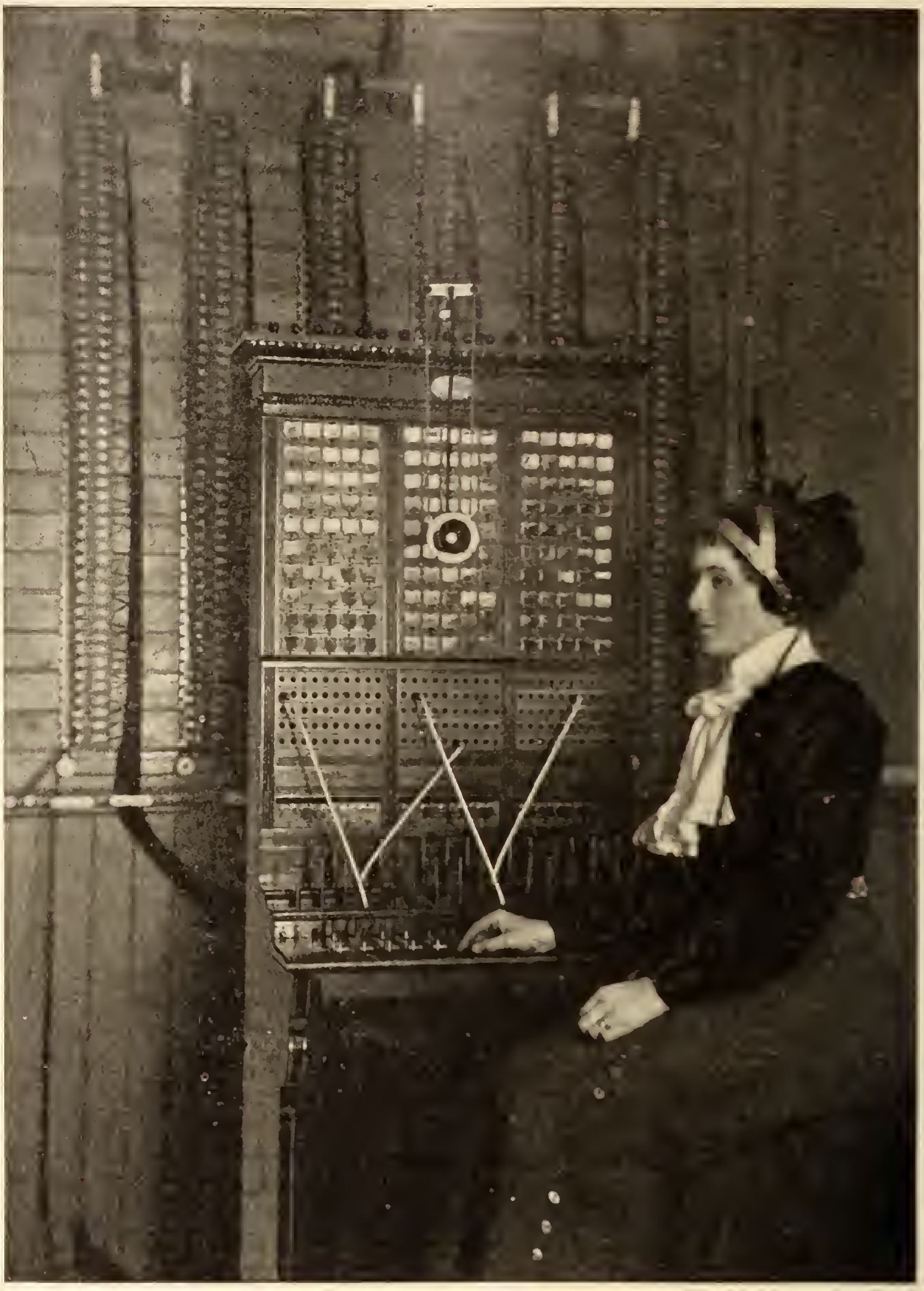
THE NERNST LAMP IN GERMANY.

From a lecture given by Dr. Nernst in Berlin it appears that Nernst lamps are now being made by the Allgemeine Elektricitats Gesellschaft in 25, 50 and 100 c. p. sizes, with a life of about 300 hours and an efficiency of 1½ to 1¾ watts per candle power. Experiments are also being made with lamps of higher candle power. The wholesale manufacture of 110 and 220 volt lamps will be commenced as soon as the new works, which are being erected by the company for that purpose, are completed. The German patent office has dismissed all petitions against the validity of the Nernst lamp patents.

The town of Berlin has given a contract to the Berlin Gas & Electric Co., for electric and gas lighting for a period of five years from October 1st, 1900.

A CIVIC TELEPHONE SYSTEM.

THE question of municipal ownership of telephone systems is at present receiving much consideration. There seems to be a growing tendency, especially in rural districts and small towns, to form local telephone companies for the purpose of furnishing telephonic communication in the immediate vicinity as well as with adjacent villages and outlying districts. Many of these exchanges are now in successful operation, especially throughout the province of Quebec and the Maritime Provinces.



SWITCHBOARD IN TELEPHONE EXCHANGE AT NEEPAWA, MAN.
(Installed by Messrs. Ness, McLaren & Bate.)

The town of Neepawa, Man., is one of the few corporations in western Canada which has shown its faith in municipal ownership of telephones. The authorities there have recently purchased from Messrs. Ness, McLaren & Bate, the well-known manufacturers of telephones and electrical supplies of Montreal, a complete outfit, consisting of a central exchange switch-board, with a capacity for 150 subscribers, and 150 long distance telephones, all supplied and installed by the above firm. An illustration of the switchboard in actual use is shown on this page. This type of board is recognized throughout Canada as the standard instrument. The drop used is very neat and occupies little room; the jack being placed immediately under the drop permits of making up the switchboard with a capacity for a large number of connections in a comparatively small space. The latest styles of exchange connections are used, such as cam levers and push buttons for generator, separate "ring off" drops, head receiver for operator when required, and also a special attachment for night alarm, the drop in falling making connection with a local battery and bell which continues ringing until the drop is reset. Connections with subscribers' lines are all made at the rear of the board in a convenient manner, each line being attached to a binding post on a numbered strip so as to be easily available for reference.

Aerial lead encased cable is generally used for connecting the switchboard with the line wires of subscribers, the distributing cable box being placed on the nearest pole and connections made there when plant is installed. Each telephone may be grounded separately or a metallic return used by having a special switch-board suited for the purpose. The latter, however, costs double the amount of the former.

That the system installed at Neepawa has given eminent satisfaction is shown by a letter received recently from the authorities. Writing on their behalf, Mr. J. W. Pattison, secretary-treasurer of the municipality, says that "While at first you made up for us and installed only 100 of your Milde long distance telephones, we have since had to order from you several additional lots of instruments, the number of subscribers having increased until we have now our full complement. The system is giving perfect satisfaction."

The independent telephone idea appears to be growing. In Sweden the telephone system is under state control, and it is said that there are more telephones in use in that country than anywhere else in the world. Throughout the United States it has already assumed large proportions.

ELECTRIC RAILWAY DEPARTMENT.

PROPOSED ELECTRIC RADIAL RAILWAYS.

For some time a system of electric railways radiating from the city of Toronto, and passing through the somewhat thickly settled districts of Central Ontario, has been agitated. The City Council of Toronto instructed the Committee on Works to submit a report on such a system. This was done by Ald. Lamb, as Chairman of that Committee, in May last. A careful study of the question was made by Ald. Lamb, who outlined a scheme the execution of which, he believes, will result in a great expansion of the trade of Toronto and be of great benefit to the city and surrounding districts.

The proposed system consists of six main lines, with four branches, the route of which is shown by the accompanying map. The total mileage of the proposed system is 354 miles. The City Engineer of Toronto estimates that the cost of constructing the system would be approximately $5,000,000, made up of $2,850,000 for construction of tracks, grading, bridging, etc., and $2,150,000 for overhead work, power houses, machinery, car barns, equipment, etc. The cost of supplying power, the engineer states, will depend largely upon the amount of water power available along the different routes, and also as to the feasibility of transmitting power from the Niagara Peninsula.

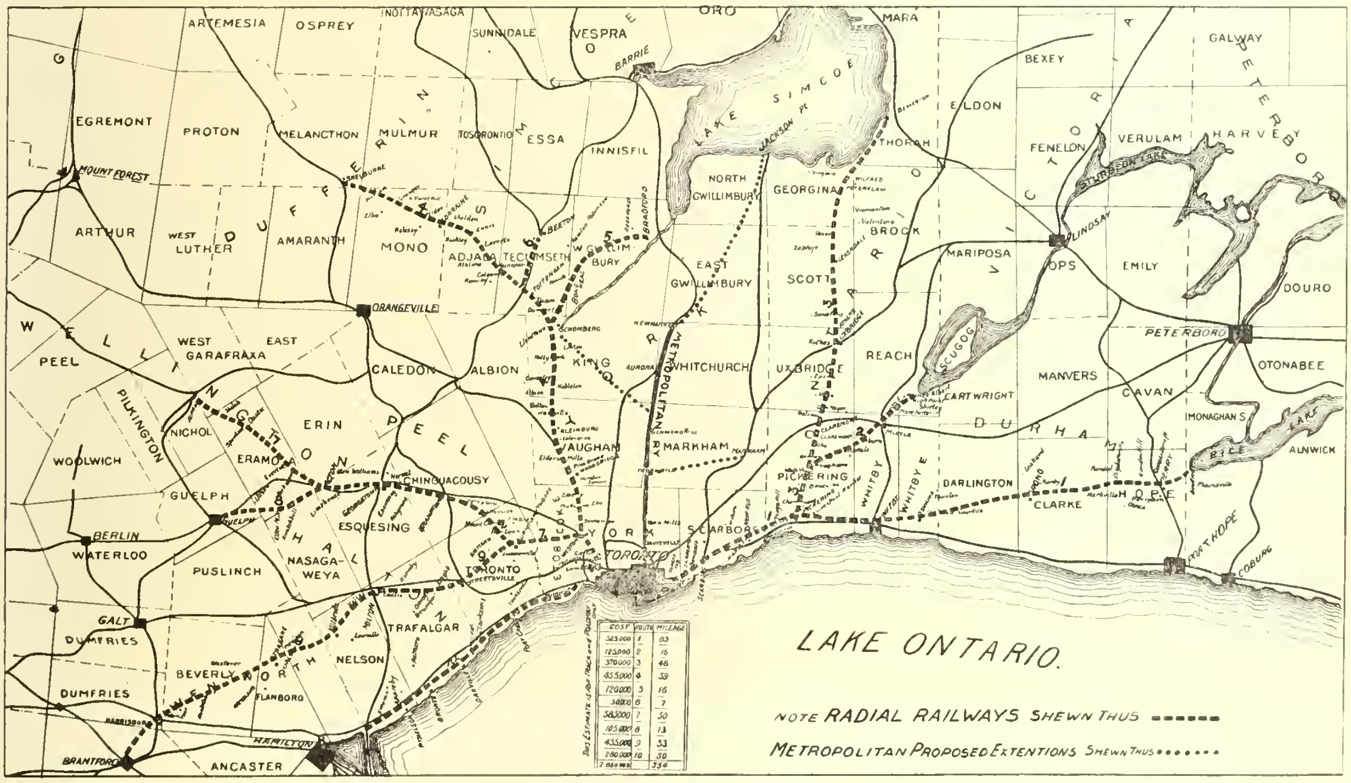
The assessed value of the city of Toronto is $125,736,000, and that of the townships through which it is proposed to extend the radial system $91,578,618, making a total assessed value of $217,314,618. The population of Toronto is 225,000, and of the townships 187,834.

The following propositions for building the system have been made by Ald. Lamb :

1. That the city of Toronto, together with the townships to be benefitted, could jointly build and equip the entire system at a cost of $5,000,000 by the issue of bonds bearing interest at 3 per cent., said bonds to be guaranteed by the respective municipalities in the proportion of their assessed values. The total value of bonds would be equal to a guaranteed assessment of 2½ per cent. upon the respective assessed value of each municipality. The interest of such guaranteed bonds would be the first charge upon the earned profits, so that in all probability there would be no expense incurred to the different municipalities except the liability of a guarantee.

2. The city and townships could contain control of the system as a public franchise by constructing the tracks, bridges, etc., at a cost of $2,850,000, under the same financial basis as above, and inviting tenders under certain terms and condtitions for operating the road, the contractor supplying all overhead work, electric plant, cars, etc., and the guaranteed interest upon the municipal bonds to be the first charge.

3. The city of Toronto, the counties or townships to combine for the purpose of advertising for tenders for the exclusive privilege of constructing and operating the proposed railways.



Proposed System of Electric Radial Railways from Toronto.

A further step has just been taken by Ald. Lamb, who is having prepared an act to incorporate the Toronto and Central Ontario Electric Radial Railways, with a capital of $5,000,000, to construct and operate the system in conjunction with the different municipalities. He is said to have received positive assurance that such a company could be financed in New York city, but Canadian capitalists will be given the preference.

The routes as suggested on the map are not final, but may be changed to others more advantageous or to suit the financial support given by such townships as may wish to avail themselves of the system. An adjunct to the scheme is the extension of the Metropolitan electric railway from Thornhill east to Markham, from the main line just north of Richmond Hill west to Schomberg, and from Newmarket north to Jackson's Point.

The construction of such a system of electric railways could not but prove of great benefit to the country districts. It would increase the value of the farms in the several localities and provide the farmer with an easy means of getting his produce to market. In the United States similar systems are said to be operated with success and as a profitable investment to the promoters

ENGINEERING and MECHANICS

BANQUET OF STATIONARY ENGINEERS.

The annual banquet of Toronto No. 1, Canadian Association of Stationary Engineers, will take place at the Walker House, Toronto, on Thanksgiving eve., October 17th. Such arrangements have been made as ensure an evening of pleasure. The local committee is composed of Messrs. G. C. Mooring, president; J. W. Marr, secretary; W. L. Outhwaite, treasurer; W. J. Webb, A. M. Wickens, H. E. Terry, S. Thompson, John Fox, A. Storer and Jas. Bannon. The tickets are one dollar, and may be obtained from any member of the committee.

CHIMNEY CONSTRUCTION.*

By E. J. Philip.

THE construction of chimneys does not give us much thought, like many other things we have to deal with, until we have to construct one, and when you begin to look up facts it will surprise you how little real information there is to be had on the subject.

In the old country, where there are many large chimneys used for all purposes, there is on record much information both in reference to building, straightening and taking down. Most of the very high chimneys are used for other purposes than producing draft to burn coal, such as carrying off the poisonous gases from chemical works, etc. There is a book published called "Tall Chimney Construction," which gives the general details of many stacks built in the old country, and from these records you can make formula to guide you in designing a new stack.

Let us consider what is the proper method of designing a chimney for any given purpose. The first question is, "What is the chimney for, or what is it to do?" for this will govern some details of the shell. For instance, if it is to produce draft for ventilation, it will not require to be lined with fire-brick, nor will there be any benefit in putting in a loose lining.

We will suppose the chimney under our consideration is to induce draft to burn coal, as that is the most likely duty of any chimney that we will be connected with.

The size of the flue is the first dimension you will require, and it will depend on the quantity of coal to be burned and the velocity of the gases up the shaft. It is easily understood that as chimney powers increase the dimensions do not increase proportionately. To illustrate this I will take some figures from a table in a reliable work:

A chimney 70 ft. high, 30" diameter = 100 h.p.
" " 200 ft. " 66 in. " = 1000 h.p.

That is, the high chimney with five times the area equals ten times the power; and while I am not sure that this proportion is right, it seems to illustrate the way the formula works. The only correct way is to calculate the number of cubic feet of gas going up the chimney at the average velocity, and the area of this column is the area of the chimney. The rate of combustion depends on the draft, and the draft depends on the height of the chimney and the temperature of the gases. The height of the stack is nearly always determined by the surroundings, as the stack must of necessity be above any buildings or hills, and I might say that the average stack is higher than is necessary. However, when there are no buildings or hills, the following formula will establish the height. This is known as Gale's formula:

$$=H\frac{120}{T}\left(\frac{F}{g}\right)^2$$

After getting the height, the area may be obtained by Kent's formula, which is: $A=\frac{.06F.}{\sqrt{H}}$ In this rule the effective area is obtained and is two inches less all round than the actual area. This two inches is to make up the friction of shaft. We now have area of chimney and height of it. I might say that experience has shown that to burn hard screenings requires 175 feet stack, for buckwheat 150 feet, and for soft coal 80 to 100 feet. This is a pretty fair basis to start from. We will suppose our chimney is, say, 100 feet high and 40 square feet area. It looks a simple matter to construct a stack having this information, and so it is, only you must go about it in the right way. To continue your calculations after getting the size, you start at the top and work down. Authorities say that a chimney having a flue over five feet in diameter shall be 1½ brick thick at the top; from three to five feet in diameter, one brick; and under three feet, half a brick. A chimney five feet or over would have this size for the first 25 feet down and would increase ½ brick for each 25 feet. This, according to calculations, is almost too much. It can run 30 to 40 feet each stage, but will depend on kind of material, that is, whether hard or soft brick, and whether built in cement or lime; 30 to 40 feet will work with good material and workmanship. Having laid out the different thicknesses of wall, and knowing the batter, which varies with different builders and conditions from 1/16 to ⅜ of 1 inch, having this you can get the weight of shaft or chimney proper. In large chimneys it is usually specified what they shall weigh per cubic foot. After getting weight you can decide how much bearing surface you will require for the kind of soil you have at the foundation. Various bearing powers of soil are given as follows: Hard rock, native bed, 100 tons sq. foot; clay, dry, 4 to 6; moderate dry, 2 to 4; soft, 1 to 2; gravel and coarse sand, 8 to 10; sand compact and well cemented, 4 to 6; clean dry sand, 2 to 4; quicksand and alluvial soils, to 1 ton per square foot.

When the ground is soft you would require piling or timbering, and to spread it out over a considerable surface. The weight in tons divided by bearing power of soil gives surface required. Wind pressure is also an important factor in getting the area of the base. I will not go into the rules affecting wind pressure, but experience has shown that at the base of shaft proper its diameter shall be 1/10th of height for square chimney, 1/11 for octagon, and 1/12 for round. In considering wind pressure it is usually figured at from 25 to 56 lbs., by different authorities. This must be resisted by foundation, as you can see that if the chimney rocks over with wind it will throw its entire weight on one side of foundation. In considering wind pressure it is necessary to take into account whether chimney is protected by buildings or standing in an open field. If the chimney is built into a building, windage may be almost disregarded except for piece above the roof.

There has been a great deal written and many discussions as to the merits of different shaped flues, but experience and tests have shown that a parallel flue is the best or as good as any shape. The arguments for taper flues are something like this, that the gases slow down due to cooling as they go up, and consequently they require more room, and the flue should get larger; others say that the gases cooling down contract in volume, and therefore the flue should get smaller so as to take the same shape as the column of gas. Experience has shown that both are correct. The gases contract and get smaller and consequently need less room, but they also slow down in velocity, due to their greater weight and therefore need more room. In this way they just balance up and require a parallel flue. Authorities say a round parallel flue is the best for all purposes, and the nearest approach is the next best.

The chimney should be finished with a cap of some material that will stand the weather. I like cast iron best, but a cap can be moulded of Portland cement, and if the stack is for smelting work, of fire clay. These materials stand well, and if there is a ladder on the chimney they can be kept in repair. A ladder should always be built on the shaft, as it makes a means of examining it at any time, and if repairs are needed they can be done easily.

Lightning conductors are also approved and disapproved; but if a chimney is the highest object in its vicinity it is likely to take the discharge from a storm over it, and a properly erected conductor will carry it off, although many stacks are standing without any.

The Cayuga Electric Light Company, of Cayuga, Ont., recently suffered the loss of their electric light plant by fire.

The electrical kitchen is a feature of the Paris Exposition, it being probably the most elaborate affair of its kind ever installed. Between three hundred and four hundred guests have been cared for daily. The mean consumption of electricity amounts to about six cents per guest per day. The main advantage with the electric kitchen is the rapidity with which food can be cooked and the absence of smoke and all possible danger of fire.

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* Paper read before the Canadian Association of Stationary Engineers.

ENGINE ROOM NOTES.

W. H. Wakeman, in the Wood-Worker.

It is always a good plan to watch an engine carefully for loose pins, setscrews and nuts, for an ounce of prevention of accidents in this way is worth several pounds of cure, after an engine is wrecked by the failure of a governor to do its duty.

Grate bars should fit the furnace so as to prevent waste of fuel; but they should not be wedged in so tightly that when they are expanded by heat they will be ruined.

Friction clutches and cut-off couplings are a great convenience in a mill or factory; they enable the operatives to quickly stop a line of shafting in case an accident happens, without waiting to get word to the engineer. They also save power by making it convenient, or possible, to allow one or more lines of shafting to remain at rest, when not needed for use.

When selecting hangers, choose those which will admit of taking out the shafting without removing the bolts holding the hangers; in case of repairs it may save much time and expense.

When laying out holes in belts for lacing, do not locate them so near together that the strength of the belt will be seriously impaired; and after you have laced it, draw in extra pieces of lacing so that they will come between belt and pulley when in use, as they will save the lacing that holds the belt together.

It is poor policy to allow any kind of packing to remain in use too long, and especially so in the case of valve stems on Corliss engines, which are often made of a composition that is easily cut and grooved.

When an injector has worked well for some time, then declines further service, examine the feed pipe to boiler and see if it has become choked with scale and sediment.

It is a good plan to use a little oil on asbestos wicking, when packing valve stems, but if much is put on it makes an unsightly mess on the bonnets of nickle-plated radiator valves and in other similar places.

It is very annoying to an engineer who understands his business, to find that as soon as the flywheel begins to revolve in the morning, or when starting up after dinner, some workman in the shop has started a heavy machine into operation. As a rule these machines do not turn out good work when running at a slow speed; but whether they do or not, they should never be started until the engine has attained its full speed. Machinery in silk mills and similar places are exceptions to this rule, but wood-working machinery is not.

Metallic piston rod packing is a very good thing to have, but some kinds are made in the form of a wedge, and if an engineer screws the nuts on the studs up tightly, he may get himself into trouble; therefore he should go slowly until he fully understands the construction of the packing in his stuffing box.

If the indicator diagram from your engine shows an imperfection for which you cannot account, be sure that the indicator piston is well oiled before losing sleep to worry over it, for the oil may change the whole aspect of affairs.

Boiler compounds are necessary in many cases, but as soon as scale is removed from the shell and tubes, it should be taken out without delay, as it may cause the crown sheet to be burned.

Flange unions in the main steam pipe between the lubricator and the cylinder should be packed with asbestos millboard, copper gaskets, or some other substance that hot oil will not dissolve.

Where a jet condenser is in use, some of the exhaust steam will find its way back into the boiler, after being condensed and passing to the hot well; therefore measures should be taken to remove cylinder oil from it before it is condensed.

If the main belt on your engine has run steadily for years or months, and then begins to "flop" in an unreasonable manner, do not hasten to saw a piece out of the floor through which it runs, nor yet to cut a piece out of the belt, but apply an indicator and see if the valves do not need resetting.

Every pound of back pressure on the piston of an engine means another pound of forward pressure, which in turn means more fuel for the boiler, hence the back pressure should be reduced to the lowest point possible. This is what a condenser is used for.

At the time of going to press the tenders received for electric light and power plant for the corporation of Morrisburg, Ont., have not been made public.

SPARKS.

The Royal Electric Company are said to have decided to close down the electric plant at Aurora, Ont.

Mr. S. Glass, chief engineer of the Victoria Hospital, London, has recommended that a third boiler be put in.

The Cataract Power Company, of Hamilton, have put in a new 3,000 horse power turbine at their DeCew Falls power house.

Reeve Savage, of Richmond Hill, Ont., will submit to the council of that village a proposition for a system of municipal electric lighting.

Mr. Roderick J. Parke, E.E., of Toronto, has been advised by the town council of Perth, Ont., of his appointment as valuator for the town.

The Water Committee of the Montreal City Council has decided to call for tenders for the proposed electric motor plant for the high level reservoir.

The ratepayers of Almonte, Ont., will vote on a by-law on October 20th to raise $30,000 by the issue of debentures to establish an electric light plant.

There is a deadlock between Messrs. Eager & Sanderson and the village council of Winchester, Ont., over the price for electric lighting. If an agreement is not reached the lights may be discontinued.

The Berlin Furniture Co., Berlin, Ont., have placed an order with The Electrical Construction Company, of London, Limited, for a 150 light multipolar dynamo to be installed in their new factory.

Col. Tracey, of Vancouver, has estimated the value of the property of the Revelstoke Water, Power & Light Company, of Revelstoke, B.C., at $69,970. The company asks for the property $76,775.

The tender of the Goldie & McCulloch Company, of Galt, for an engine and boiler for the Newmarket electric light plant, has been accepted. Plans for an addition to the power house have been made.

Adelard Bolduc, of Hull, is issuing the Hull Electric Company for $10,000 for the death of his son, who was killed by an electric car. The plaintiff claims that the car was running at a high rate of speed and was not provided with a fender.

The Electrical Construction Company, of London, Limited, have secured the contract for the supply of a 600 light generator, and for the complete wiring of the new buildings of the McLaughlin Carriage Co., Oshawa, Ont.

The Standard Light & Power Company, of Montreal, have elected directors as follows: President, W. McLea Walbank; vice-president, J. H. Burland; secretary, D. Craig; Peter Lyall, S. Finley, W. S. Evans, L. Henault and R. Wilson Smith.

Mr. E. B. Douglas, president of the Sault Ste. Marie Pulp & Paper Company, has placed before the councils of Fort William and Port Arthur, Ont., a proposition to supply these towns with electric light and power, developed from the Kakabeca Falls.

Negotiations are said to have been in progress for the purchase, by an American syndicate, of the plant of the Trenton Electric Company. The purpose of the syndicate is said to be to largely increase the present capacity of the plant. We have not learned that the purchase has yet been consummated.

The Brandon Electric Light Company, of Brandon, Man., are making good progress with the development of the power of the Little Saskatchewan river. The work of building the dam is nearing completion, and the power house has been commenced. It is probable that the town waterworks will be operated by electricity.

The Parry Sound Electric Light Co. are remodelling their power house and putting in two new boilers and one new engine, manufactured by the Waterous Engine Co., of Brantford, and one 75 k.w. monocyclic generator. The plant, when fully equipped, will consist of three water-wheels, two monocyclic generators of 75 k.w. each, and an auxiliary steam plant of 150 h.p.

The incandescent oil lamp invented by Mr. V. L. Emerson, of Ottawa, was recently given a test in that city. Six 16 candle power electric lights, we are told, illuminated the room in which the party of witnesses sat, and one student lamp, the globe of which was of about the size and appearance of the ordinary auer burner, was placed on the table. This light was constantly turned on and off to show the contrast between the six 16 candle-power electric lights and the new invention, and it is reported that the difference in brilliancy was remarkable.

DYNAMO PLANT FOR TELEGRAPH WORK.

The C. P. R. Telegraph Company have installed a plant of motor generators in their Toronto office, to supply current to their circuits. The plant is located in the old battery room, which formerly was filled with battery stands supporting some two thousand cells, all of which have been done away with—the dynamo room now occupying about one-quarter of the space which had been taken up with battery jars. The machines consist of twelve Lundell motor generators, manufactured by the Sprague Electric Company, resting on two heavy wooden stringers raised 30 inches above the floor. Connection is made by means of twelve 5-conductor cables (one cable to each machine) with the switchboard, consisting of a slab of slate on which are muonted the necessary switches. The switchboard is bolted to a framework of angle iron secured to the floor and ceiling. On each side of the switchboard, mounted on wooden cross-bars bolted to the iron frame, are the rheostats, one for each machine; above the switchboard are the ammeter and voltmeter, of Weston make. The voltmeter is provided with a flexible conducting cord and wedge, by means of which the voltage of any circuit can be taken. By means of a double throw two pole main switch connection can be had with either the overhead or underground circuits of the Toronto Electric Light Co. In the circuit between the main switch and the motor switches is placed a reversing switch, which is used on occasions when service current happens to be reversed. In the main circuit there is also a regulating rheostat and an underload switch. On the upper part of the switchboard are located the secondary switches, by which connection is made with the cable leading to the operating room, where the secondary currents are distributed to the wires through lamp resistances. The machines are wound for 225 volts primary, the secondary ratings being as follows: One of 100 volts, 2.5 amperes; two of 30 volts, 34 amperes; three of 130 volts, 3 amperes; three of 200 volts, 2.5 amperes; and three of 400 volts, 2.5 amperes. It being necessary to run only seven machines constantly, one machine of each voltage is allowed to remain idle in reserve. The secondary switches are so arranged that the machines can be transposed without interruption to continuity of current supplied to operating room.

PERSONAL.

Mr. Wm. Tarlin, late of Mitchell, Ont., has been appointed manager of the electric light plant at Palmerston, Ont.

Mr. Thos. Potter, who for eleven years past was superintendent of the Walkerton Light and Power Co., has recently resigned.

Mr. Walter Stillwell, head dynamo tender for the St. John Street Railway Company, has resigned, to accept a position in Sydney, C. B.

Mr. Andrew Ingram, of Seaforth, has removed to Kincardine, where he becomes superintendent of the electric light plant owned by the town.

It is announced that Mr. W. E. Gower, C. E., of Montreal, will in future reside in Great Britain as the representative there of the American Stoker Company.

The Electrical News recently had the pleasure of a call from Mr. Harvey Hubbell, an extensive manufacturer of brass machinery screws, of Bridgeport, Conn.

Mr. Geo. Patterson has resigned the management of the Amherst Electric Light Company, of Amherst, N. S., and purposes spending the winter at his home in Truro to recuperate his health.

Mr. G. F. MacDonald, city electrician of Ottawa, Ont., attended the recent convention of the Association of Municipal Electricians held in Pittsburg, Pa. Mr. MacDonald was honored by being re-elected vice-president of the association.

It is with pleasure that we notice that Mr. P. McCullough, late chief electrician for the Toronto Railway Company, who went to England a few months ago, has been appointed assistant manager of the municipal tramway system at Liverpool, England.

Mr. L. W. Gill, B. A. Sc., of Montreal, has been appointed lecturer in the newly appointed chair of electrical and mechanical engineering in the Kingston School of Mining. Mr. Gill is a gold medalist of McGill and will no doubt fill his appointment in an acceptable manner.

Mr. E. J. Philip, who for a number of years has been chief engineer for the T. Eaton Company, Toronto, has tendered his resignation. Besides having the surpervision of the large electrical and steam plant, Mr. Philip acted as mechanical superintendent of the entire establishment.

Mr. Ralph D. Marchand, who for some years was expert for the Westinghouse Electric and Manufacturing Company in connection with the long distance transmission of electricity, is reported to have accepted a similar appointment with the Montreal Street Railway Company and the Chambly Manufacturing Company.

SPARKS.

The talk of an electric railway from Yarmouth to Digby, N.S., has been revived.

Mr. Edmund Conway, of the Quebec Railway, Light & Power Company, has been granted a patent on a street car fender.

Judge McDougall has been named as arbitrator in connection with the purchase of the electric light plant by the town of Woodstock, Ont.

The annual meeting of the Merchants Telephone Company, of Montreal, was held in that city a few days ago. The directors were re-elected.

A syndicate is negotiating for the purchase of Lake Park from Mr P. P. Salter, with a view to improving the park and building an electric railway to Carleton Place.

The Goderich Engine and Bicycle Company are now manufacturing the Whiting automatic pump, having acquired the exclusive right to manufacture this pump in Canada.

Mr. John Patterson, secretary of the Cataract Power Company, Hamilton, has made application to the township councils of Barton, Saltfleet and Grimsby for right of way for an electric railway. The line may be built next spring.

The Sarnia Street Railway Company are asking for tenders for ties, poles and overhead construction in connection with the conversion of the street railway at Sarnia, Ont., to an electric system.

The Cataract Power Company and other Hamilton capitalists have formed the Patterson Coal & Coke Company, of Pennsylvania. A large tract of coal lands in the Pennsylvania district has been acquired, and it is the intention to bring soft coal to Hamilton and establish large coke ovens adjoining the city.

The street railway of St. Thomas, Ont., has passed into the control of a new directorate, of which Mr. E. H. Coughall and Mr. J. W. Moyes, the latter of the Metropolitan Railway, of Toronto, are members. It is said that the road will be extended to Port Stanley. The company have already running privileges in Yarmouth and Southwold. Mr. E. H. Coughall will become manager.

The Niagara, St. Catharines & Toronto Railway Company have been granted, by the Stamford township council, an extension of time to May, 1901, to complete the Niagara Falls, Wesley Park & Clifton Electric Railway on Murray street. Mr. Edward Baxter and others have applied to the township councils for a franchise to build an electric railway from Chippewa to Falls View, Ont. Attorney O'Brien, of Buffalo, is looking after the charter.

The nineteenth annual convention of the American Street Railway Association will be held at Kansas City, commencing on October 6th. Papers on the following subjects will be read: "Double Truck Cars; How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions."; "Comparisons of the Various Systems of Electrical Distribution for Street Railways"; "Consolidation of Street Railways and Its Effect Upon the Public"; "The Store Room and Store Room Accounts" "Painting, Repainting and Maintenance of Car Bodies.

The Sarnia Electric Light & Gas Company have just reconstructed their plant, which now consists of two boilers, two engines, one alternator and one arc machine. The smaller engine is a single cylinder of 100 h. p., and the large one a tandem compound of 250 h. p., both of the automatic cut off Wheelock type, and belted to a new shaft, arranged with friction clutches in such a manner that either engine or machine can be used, or both. The main driving belt is 26 inches in width and 90 feet long. There is a duplex condenser, manufactured by the Northey Company, of Toronto. The alternator is a T. H. machine of 1000 lights capacity, and the arc machine is of the Wood system, capable of supplying 75 1,200 c. p. lamps. Both machines were supplied by the Canadian General Electric Company, of Toronto. The work of construction was carried out under the supervision of Mr. Wm. Williams, manager and secretary of the company. Mr. Geo. Shand is engineer in charge.

SPARKS.

A Detroit electrical firm has secured the contract for wiring for electric light the House of Refuge at Leamington, Ont.

The Elmvale Electric Light Co., Elmvale, Ont., have just installed a steam heater, supplied by H. W. Petrie, of Toronto, and a steam pump.

The tender of the Goldie & McCulloch Company, of Galt, has been accepted by the council of St. Mary's, Ont., for furnishing engines, boilers, etc., for the electric light plant. Elliott & Clyde will build the power house.

The Wolfville Electric Light & Heat Company, of Wolfville, N. S., have purchased water power privileges on the Gaspereau river from Mr. S. P. Benjamin. The extent of land involved is 30,000 acres and the consideration $30,000.

The town of Cayuga, Ont., is about to install an electric plant to supply private and street lighting, the plant there having been recently destroyed by fire. Mr. H. F. Strickland, E. E., of Toronto, is acting as consulting engineer for the corporation.

The by-law to borrow $10,000 to extend he electric light and water works plants owned by the corporation of Newmarket, Ont., has received the sanction of the Lieutenant Governor of Ontario. This will remove the necessity of submitting the by-law to the ratepayers.

Mr. L. J. Marien, superintendent of the Montreal waterworks system, has made a report to the city council on the question of increasing the water supply. He recommends that the sum of $30,000 be appropriated for the purpose of installing two electric pumps and the necessary motors at the high level reservoir. He reports that the superiority of electricity over steam, as a motive power, results from the inconvenience connected with the use of coal, also that the saving effected by the use of electric power would very soon reimburse the capital invested.

FOR SALE—A Five-Hundred Alternating Westinghouse Dynamo; one thousand volts. G. FENSOM, Chesley, Ont.

Accountant Wanted

Experienced Street Railway and Central Station Accountant. Give references and state salary expected. Address General Manager,
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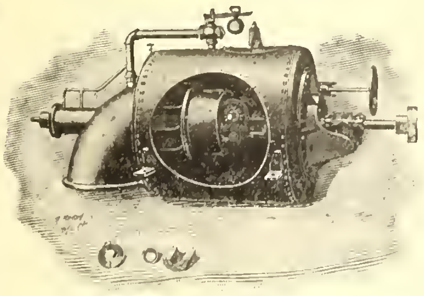

Where the nature of the location will permit its use this type has many advantages. It is very suitable for direct connection to dynamos, and many are in operation in this class of service.

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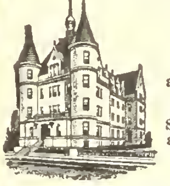

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RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Quebec Railway, Light & Power Co., Quebec, 4,000 h.p.; The Ottawa Electric Co., Ottawa, Ont., 2,000 h.p.

CORRESPONDENCE SOLICITED
THE
Stilwell-Bierce & Smith-Vaile Co.
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DAYTON, OHIO, U. S. A.

TRADE NOTES.

The Jackson Cochrane Co., Berlin, Ont., have purchased from the Electrical Construction Company, Limited, of London, one 75 light multipolar dynamo.

Messrs. Jack & Robertson, Montreal, Canadian agents for the Sprague Electric Company, have recently sent out to the trade Bulletin No. 200, descriptive of the Lundell motor equipments for printing establishments and book binderies, and Bulletin No. 400, relating to the Greenfield flexible steel armored conductors.

The Electrical Construction Company, of London, Limited, report the following sales during the past month: Ness, McLaren & Bate, Montreal, one 5 h.p. bipolar motor; Oram & Carter, Kingston, one 8 h.p. bipolar motor; L. Allcock, Sault Ste Marie, one 5 h.p. bipolar motor; The Rehder Plating & Mfg. Company, Thorold, Ont., one 12 h.p. motor; G. E. Matthews, Montreal, three machines of different sizes.

We are pleased to learn of the establishment of the Canadian Correspondence Schools of Toronto, the purpose of which is to carry on correspondence instruction by mail, after the manner of the correspondence schools in the United States. Among other subjects, the schools will have courses of instruction in electric lighting, electrical engineering, stationary steam engineering, and hydraulic engineering. Mr. A. J. Pell is manager and treasurer, and Mr. E. H. Richard superintendent of instruction.

In honor of the tenth or "tin" anniversary of the Canadian Electrical Association, Mr. E. E. Cary, one of the vice-presidents of the association and manager of the Packard Electric Company, of St. Catharines, is sending out a perpetual calendar, handsomely framed in aluminum, which is the nearest approach to permanent tin which could be found for the purpose. In addition to the calendar the frame bears on its face a thermometer, intended, we presume, as a reminder to business men to keep cool even at the expense of an electric fan.

The business of the Eugene F. Phillips Electrical Works, at Montreal, has so increased that the manufacturing capacity of the works has become altogether inadequate, and arrangements are being made to enlarge the factory. For many months past the works have been operated day and night. A number of improvements have been made in the plant, which have assisted the company in meeting the demands of customers. Among other large orders, the company have supplied bare copper wire to the value of about $40,000 for the Cataract Power Company's second transmission line between their generating station at DeCew Falls and Hamilton. The management of this rapidly growing industry is now in the hands of Mr. George H. Olney.

The Canadian Heine Boiler Company, of Toronto, are just installing two 410 h.p. Heine boilers in the T. Eaton Company's departmental store, in addition to five boilers of 150 h.p. each already installed. They are also installing two 410 h.p. boilers for the Toronto Electric Light Company, in addition to five of 250 h.p. each and two of 410 h.p. each previously used in operating that company's plant. This makes a total capacity of 3,960 h.p. in Heine boilers installed in these two establishments. The Canadian Heine Boiler Company are also putting in a 150 h.p. boiler for the Toronto Biscuit Company, and two 250 h.p. boilers for the Gutta Percha & Rubber Company, who already have one of similar capacity in use. They have just completed, and started in successful operation, two boilers of 250 h.p. in Lever Bros.' soap works.

SPARKS.

Mr. W. C. Caldwell has purchased a dynamo of 500 lights for lighting his mill at Lanark, Ont.

The council of Hespeler, Ont., want an engineer to take charge of the municipal electric plant.

The new pole line of the Cataract Power Company, from the power house at DeCew Falls to Hamilton, is about completed.

The Electrical Construction Company of London, Limited, have received orders from their Winnipeg agents for one 15 h.p. multipolar motor, one 16 h.p. multipolar motor, and one 8 h.p. bipolar motor.

The present contract for lighting the streets of the city of Montreal will expire on December 31, 1903. Ald. Ames moved in council that the Fire Committee be instructed to prepare specifications within ninety days in order to call for tenders for lighting the city after the above date. He pointed out that a new company would require two years in which to install the necessary plant. The motion carried.

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CANADA FOR THE CANADIANS.

Editor Electrical News :

Dear Sir,—I notice in your issue of last month, that you make mention, in an item p. 148, of the gratifying fact that the Canadian General Electric Company have the supply of a complete electrical plant to a Mr. Williams, of Dawson City, but when you add "Alaska" youinvest the announcement with a sting quite uncomfortable to us westerners. Our cousins to the south, true to their instincts and methods, never fail to take advantage of opportunities to place Dawson City in Alaska. We expect this from friends over there, whose propensity for claiming everything and eveybody with a record is proverbial. We do our best to set them right and to undeceive those whom they have misguided, but we don't expect to have wounds inflicted in the house of our friends. It is well-known that Dawson City has never been within a hundred miles of Alaska, and not likely ever will be—unless the 141st meridian should chance to get entangled in the ice floe, where the bight drops into the sea to the north and south, and thus get shunted eastward. 'Till then kindly make it conspicuously apparent that Dawson City, and the far famed Klondike, are an asset of our greater Dominion, and doing business at the old stand in our N. W. Territories, and oblige.

Yours faithfully,

R. B. McMicking.

CANADIAN CORRESPONDENCE SCHOOLS.

The Canadian Correspondence Schools of Toronto enter as a new factor into the educational development of Canada. Judging by the names of the gentlemen connected with this institution and the nature of the safeguards placed about the students' interests, the Canadian Schools deserve the hearty support of all. Their courses of instruction embrace tuition in steam engineering, electrical engineering, mechanical engineering, architecture, and book-keeping and business forms. The headquarters of the schools is at 24 Adelaide street east, Toronto.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrica apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. Telephone Main 3149.

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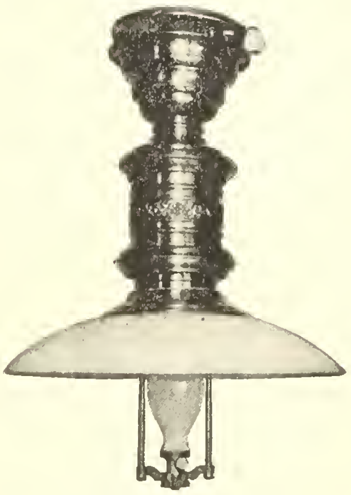

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MANHATTAN SERIES A. C. ENCLOSED ARC LAMPS

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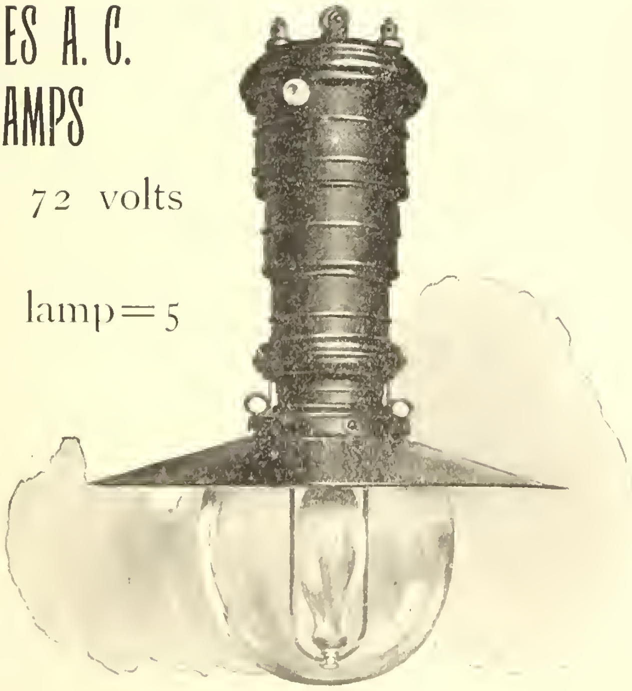
Total loss in lamp=5 watts.

Efficiency =99%.

Power factor complete circuit of Lamps and Regulator=.89.



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SPARKS.

The village council of Dutton, Ont., have given a contract for electric street lighting, for five years, to the Dutton Electric Light Company.

The council of Blenheim, Ont., have advertised for tenders for electric lighting the streets, the contract with Smith & Henderson having expired.

Mr. M. W. Crean, superintendent of the Yukon Government Telegraphs, and S. B. Charleson, supervisor of Yukon Public Works, are inspecting the telegraph line which is being built northward from Quesnelle to Atlin, B. C., which, when completed, will give the Klondike region direct communication with Vancouver, B.C. Mr. Charleson states that he will have the gap between Quesnelle and Atlin spanned by November.

The New York Electrical Review characterizes the paper presented before the Canadian Electrical Association by Prof. Herdt and Mr. Archibald, on "The Conditions Affecting the Wave Form of Alternators," as one of particular interest at this time, because so little attention has been given to this highly important subject. It has been held by some eminent members of the profession that the matter of wave form is one of small importance, but no one observing the curious double and triple-frequency effects exhibited in some of the diagrams, can fail to see that under some circumstances wave form may be of vast and vital importance. This is particularly true when the conditions of long-distance transmission are considered, where the high-frequency components of waves may, and frequently do, start resonant effects that may be highly detrimental or even dangerous. The subject is one that is well worthy of more careful attention than it has yet received, and it is to be hoped that the work outlined in the paper will be carried on further and more fully.

Messrs. Joseph Simpson & Sons, of Toronto, have recently installed a complete, up-to-date plant throughout their extensive factories. All the wiring and machinery was installed by Strickland & Company, Toronto. The generator is a 25 k. w. Canadian m. p., and is complete with marble switchboard, etc. The same firm have just completed all the electric wiring in the new Technical School, and two of the finest residential jobs of wiring in the province, being that of Mr. James Kerr Osborne and Mr. Sutherland Macklem, both of this city.

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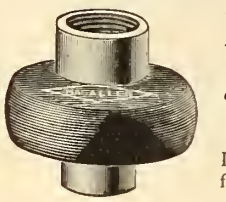

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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N. Y. Evening Post, Oct. 9 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press; and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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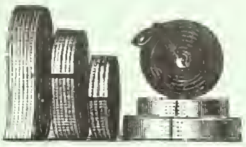

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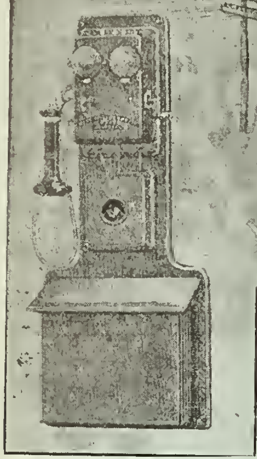

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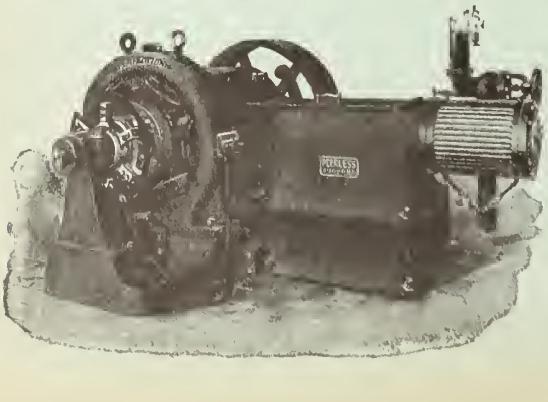

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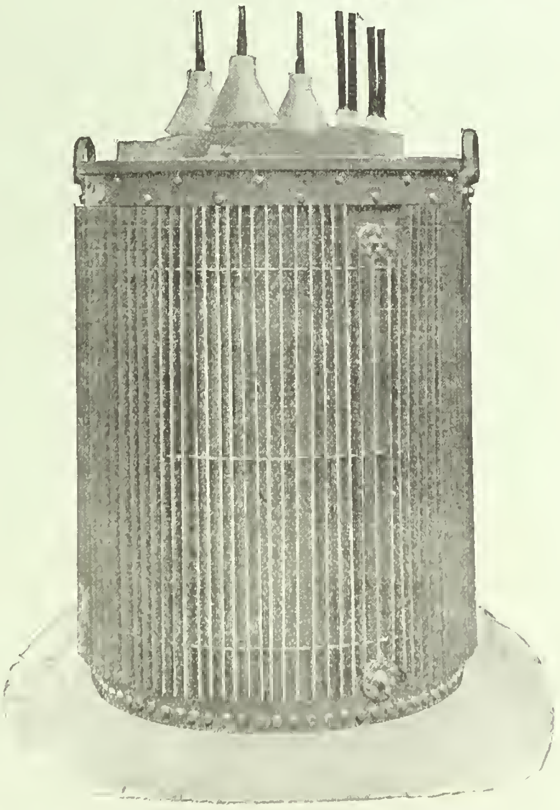

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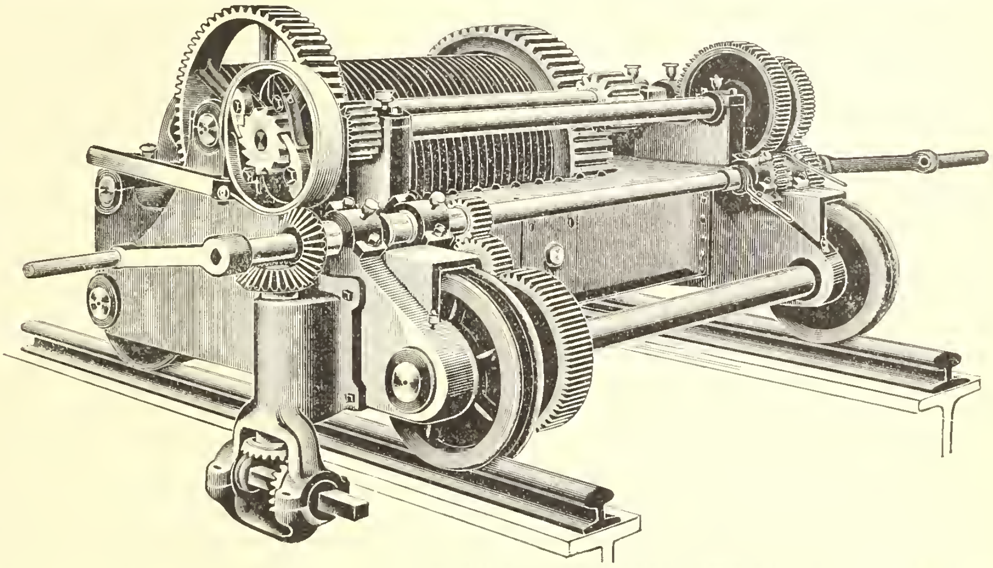

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SPARKS.

Grenville Bros., of Thorold, Ont., have commenced the manufacture of a covering for steam pipes.

The corporation of Brockville, Ont., has finally taken over the electric light and gas plants in that town.

The ratepayers of Bridgewater, N. S., have voted in favor of taking over the existing electric light plant.

Messrs. McDougall, Brandon & Austin, owners of the electric light plant at Fenelon Falls, Ont., are putting in a new 75 kilowatt machine.

The Niagara Falls Power Company is erecting a new transmission line to Buffalo. Aluminum wire is being used, and the voltage will be 22,000.

The council of Beaverton, Ont., have renewed the contract for electric lighting with Mr. Dobson for a period of five years, at the price of $450 per year.

Mr. G. A. Burgess is organizing a company at Carleton Place, Ont., to supply electric light and power. It is proposed to utilize the water power at Arklan.

With a view of preventing overcrowding the platforms of street cars, the Montreal Street Railway Company have decided that not more than four passengers will be allowed on the platform at any one time.

Incorporation has been granted by the Ontario government to the Magnetic Electric Brake Company, Limited, to manufacture a magnetic electric brake. The incorporators include G. H. B. Hooper, electrician, and W. D. Earngey, barrister, of Toronto.

Messrs. Ahearn & Soper have purchased the Little Chaudiere water situated on the Ottawa river above Tetrauville. They already own the adjacent water power property, and it is understood to be their intention to develop both powers at an early date.

A dispatch from Kingston, Jamaica, dated October 18th, stated that a street railway strike was in progress. The street railway system there is controlled by Toronto and Montreal capitalists.

The Capital Power Company, of Ottawa, will soon be in a position to supply 2,500 horse power. The E. B. Eddy will use most of this power, as they are substituting electricity for steam to a considerable extent.

The Lloyd Insurance Company, of London, England, have decided to establish a signal station on Belle Island. Telegraph communication will be on the north shore of the St. Lawrence as far as opposite Belle Isle, where it will connect with acable.

Hon. C. H. McIntosh, of Rossland, B. C., is about to leave for England on business in connection with the Stave Lake power project. This scheme, which includes the supply of electric light and power to the city of Vancouver, is likely to be commenced at an early date.

Plans are in course of preparation for the re-construction of several of the principal lines of the Montreal Street Railway Company. New rails, 60 feet in length and weighing 83 pounds to the yard, will likely be used. It is claimed that the greater length of rail gives a smoother and much more durable track.

The arbitrators as to the value of the plant of the Pembroke Electric Light Company have fixed the amount at $35,772.20. In addition to this figure the town will have to pay about $2,800 for professional fees. The town offered the company $20,000 for the plant. The council have three months in which to decide whether or not they will take over the plant. If they take it, a by-law will have to be submitted to the ratepayers to raise another $10,000 in addition to the $30,000 already voted.

Mr. J. W. Pilcher, who was employed to report on the cost of installing an electric light plant for the city of St. John, N. B., has presented his figures. For 300 arc lamps, using present pole line, the cost for equipment is placed at $88,000, made up of $15,000 for building, $25,750 for engines, boilers, shafting, etc., $1,000 for foundation, and $38,250 for electrical plant, including 26 miles of arc circuits. To provide for an incandescent plant for public building, using same boiler, but separate engine, generator, etc., the equipment for 1000 16 c.p. lamps would cost $7,850, $1,350 being for engine, and $6,500 for generators, transformers and line. The annual cost of operating 300 arc lamps all night during the year, burning 3,800 hours is placed at $26,565, and for 250 lamps $24,027.50. The estimate is based on engine capacity of 500 h. p. and three 125 light dynamos.

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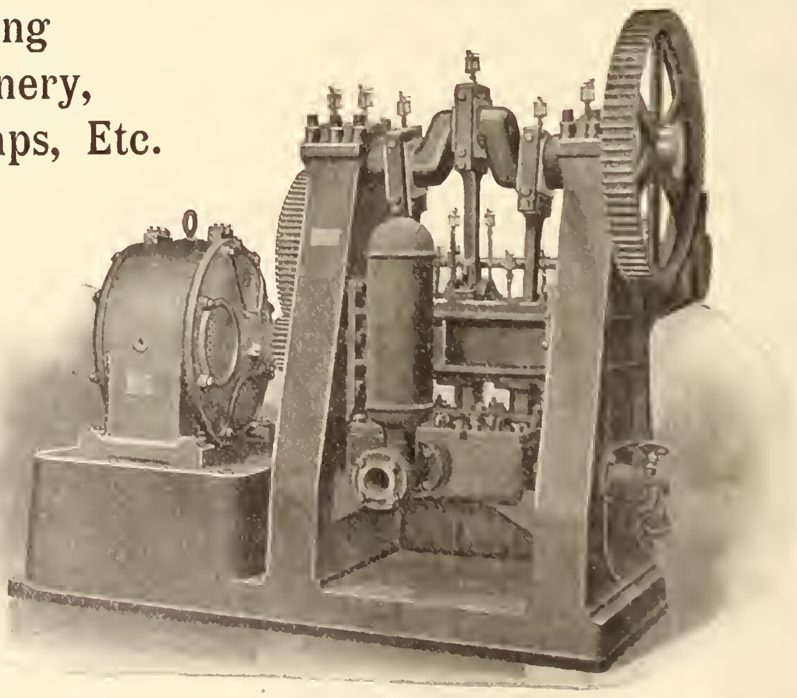

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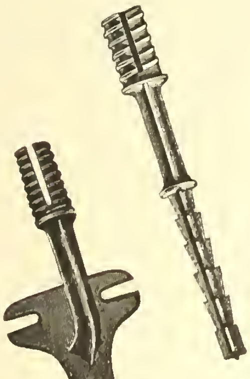

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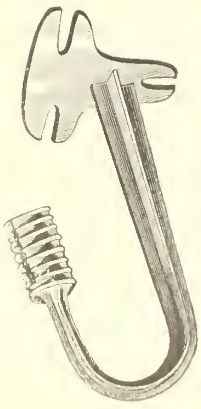

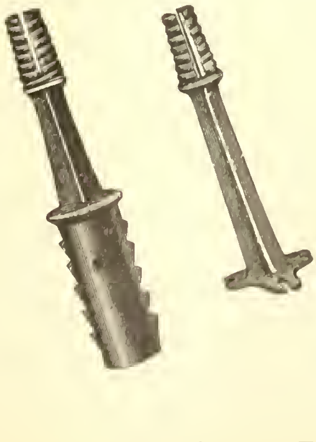

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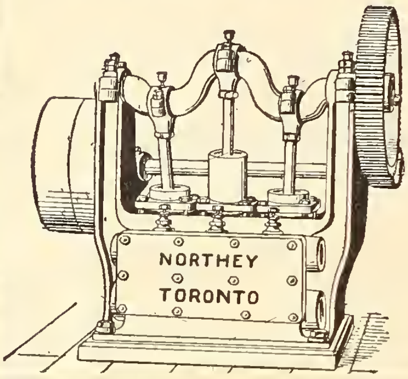

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We are also manufacturers of the Northey Gas and Gasoline Engine, which has proved to be the handiest and most convenient form of power for small or intermittent power users in the market. Suitable for machine shops, pumping and electric light plants, etc. Write for descriptive booklet.

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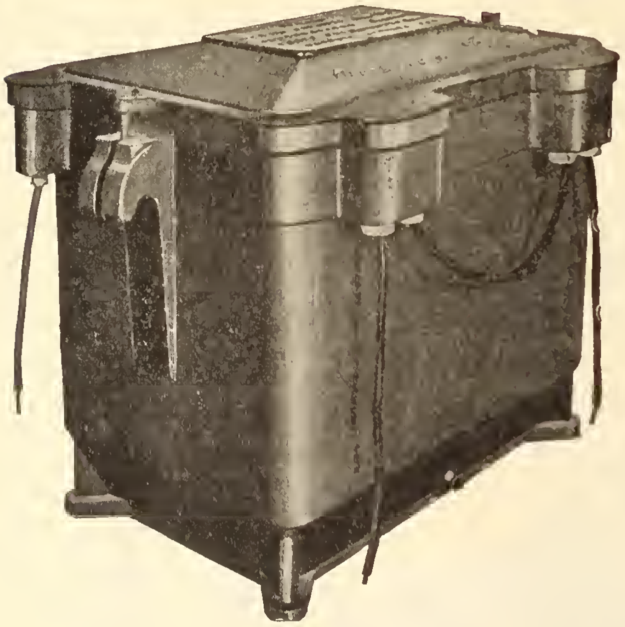

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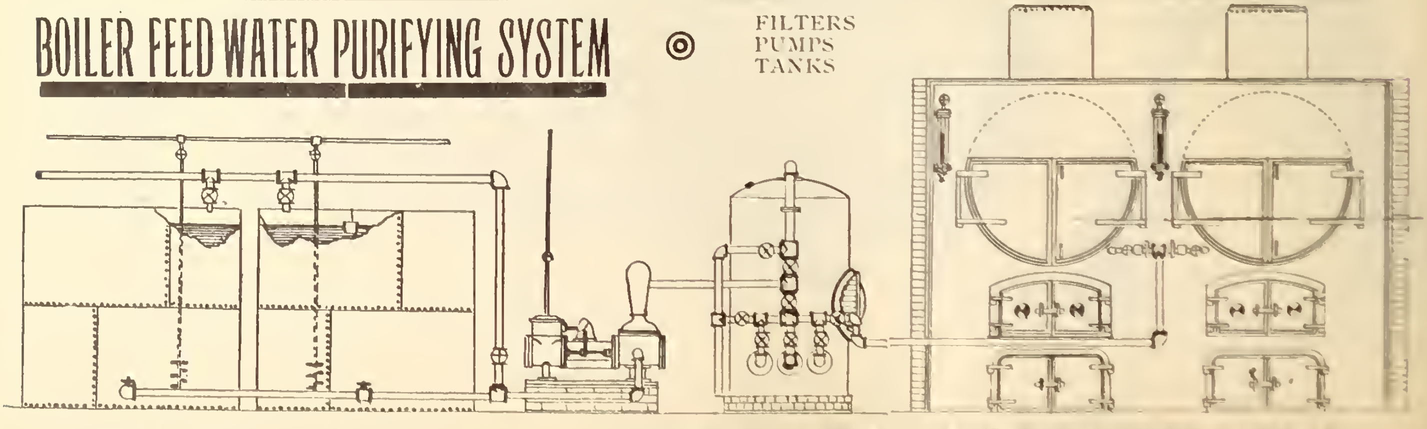

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CANADIAN
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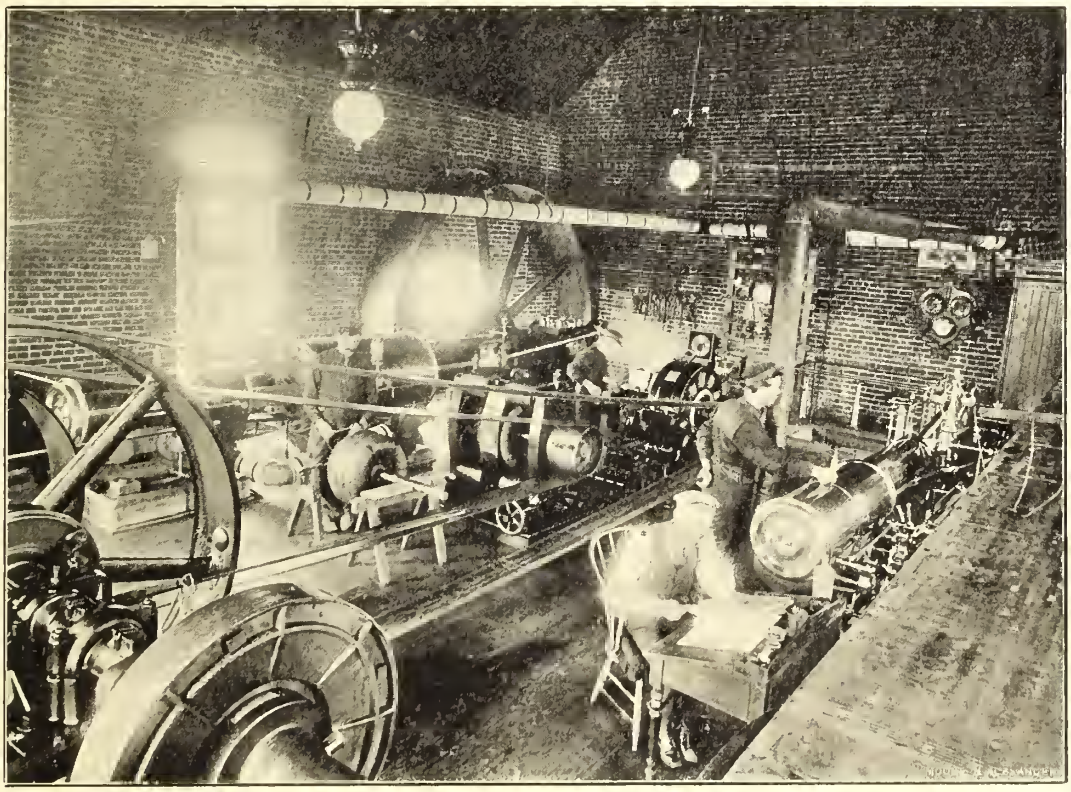
VOL. X. NOVEMBER, 1900 No. 11.

THE SARNIA GAS AND ELECTRIC LIGHT COMPANY.

As mentioned in last issue, the plant of the Sarnia Gas & Electric Light Company, at Sarnia, Ont., has been reconstructed, and modern apparatus installed. A view of the plant as rebuilt is shown on this page.



INTERIOR OF POWER HOUSE, SARNIA GAS AND ELECTRIC LIGHT COMPANY, SARNIA, ONT.

The power house is of red brick, with freestone trimmings and stone foundation. It has a truss roof, and is covered with iron, making the building practically fire-proof.

The power equipment of the plant now consists of two large boilers and two engines of the automatic cut-off Wheelock type. The smaller engine is a single cylinder of 100 h.p., and has been in use for some time. The new engine is a tandem compound of 250 h.p. capacity. Both are belted to a new shaft arranged with friction clutches in such a manner that either engine or machine may be used, or both. The main driving belt is 26 inches in width and 90 feet in length. There is a duplex condenser furnished by the Northey Manufacturing Company, of Toronto.

The electrical equipment includes a T.H. alternator of 1,000 lights capacity, and a Wood arc machine capable of supplying seventy-five 1,000 c.p. lamps, both being supplied by the Canadian General Electric Company.

The boilers, engines, shafting, pulleys and clutches were supplied by the Goldie & McCulloch Company, Limited, of Galt, Ont., and were installed by Mr. L. Ingall, erecting engineer for the company. The plans and specifications of the foundations for the machinery were prepared by Mr. R. W. Fawcett, of Sarnia, while the entire work of reconstruction was carried out under the supervision of Mr. Wm. Williams, manager and secretary of the company. The operation of the plant is in charge of Mr. Geo. Shand, chief engineer, and a staff of able assistants.

In addition to their electric lighting business, the Sarnia Gas & Electric Light Company will also supply the power for the new electric street railway now in course of construction in that town. The plant of the company as remodelled is modern and up-to-date in every respect, and should prove a profitable investment for its owners.

The St. George & Penfield Telephone Company have elected M. Eldridge president, H. H. McLean vice-president, and E. W. Cross secretary-treasurer.

In connection with the proposal for municipal control of the electric light plant at Kingston, Ont., the utilization of the water power of some of the falls adjacent to Kingston is spoken of. At Kingston Mills 400 horse power is said to be available, and at Jones Falls about 1,000 horse power.

QUESTIONS AND ANSWERS

"Reader" asks : Are both the motors in a street car always in use when the car is moving, where series parallel controllers are used.

Ans.—Yes, both motors are in use for practically all the time that the controller is turned on, the only exception being the few seconds during which the connection is being changed from series to parallel. The current, when the motors are in series, goes first through No. 1 motor, and then through No. 2, thus the same identical current goes through both motors ; when the controller is put on to any of the parallel positions, separate currents go through each motor, though if the motors are similar, and neither pair of wheels slip, the currents will be about equal.

"J. B.," Montreal, writes : I have two direct current dynamos running in parallel, driven by separate engines in different rooms ; is there any danger of one of them reversing and damaging the work going on through some other machines which are driven by the same countershaft ?

Ans.—We presume that you mean in case either engine belt come off or anything go wrong with either engine which would cut off the steam from it, to which we would answer no ; there is not the slightest danger. If by any accident the power driving either dynamo should come off, it would still continue to run as a motor, and to revolve in the same direction.

"Superintedent" writes : We are having a good deal of trouble in our pattern shop with our incandescent lamps burning out, though lots of lamps are running for over one thousand hours on other lines in the machine shop, offices, etc. I have tested all over, but cannot find anything wrong. What would you suggest ?

Ans.—Your trouble is proabably due to static electricity, which generally gives most trouble in rooms where there are many high speed belts running and much dust flying. If static electricity is the cause, you will find a very fine star shape crack towards the bottom of the bulb, which is caused by the hot filament (which is attracted by the static charge in the glass) striking the glass and cracking it. The vacuum is thus destroyed, and the air gets into the bulb and instantly burns the filament. The remedy is the use of lower efficiency, slightly higher voltage and higher candle power lamps.

"C. B.", Halifax, writes : I have two lines of shafting to be driven from one electric motor. Can I run two belts off of it, or will I have to belt from one line of shafting to another ?

Ans.—If you have room to put your motor between the two lines, it would be best to belt direct from it to each line, the belts driving each way from a special pulley having two crowns. This method has the advantage over the one in which a pulley is used at each end of the motor, of reducing the strains on the bearings and frame, and also of giving freer access to the motor for inspection and cleaning.

" Engineer " says : We are putting in a new engine in our mill, for which we will have to get a new belt about fifty feet long. As I want to get the very best service possible out of it, please advise me which side I should put next the pulley.

Ans.—If your belt is to be single, you should run the flesh or grain side out, because the outside of the belt when passing around the pulleys is subject to more or less of an extension strain, over and above the strain due only to the load it is driving ; whereas the inside of the belt as it goes over the pulley is to a certain extent compressed ; obviously, the flesh side being of a more soft and pliable nature than the hair side, is more suited to take the extension strain. If the belt is double, both sides will be grain, the hair sides being glued together, so you will have no choice in the matter.

" Subscriber," London, wishes to know why it is that persons handling a secondary line (sockets) receive severe shocks, apparently primary effects, although it is impossible to find any trace of contact between primary and secondary or secondary and ground by means of 50,000 ohm well.

Ans.—The effect spoken of is due to either : (a) The normal secondary voltage ; (b) an abnormal foreign voltage, which latter again may be due to : (c) Static charges, or, (d) a cross with a foreign circuit. (a) It must be remembered that voltages as low as 52 will often give severe shocks to certain nervous systems if their connection with the ground be good, though if all who handle the sockets experience the same effects it would seem to indicate that this is not the cause of the trouble. (b) If there are no belts in the room it is safe to say that this is not the cause. (c) If you are crossed with a line carrying a voltage higher than that of the secondary, it will most probably be a connection with the primary, in the transformer itself, though it must be borne in mind that any test to discover the fault should be made while the transformer is hot, as the cross may disappear as the apparatus cools. It may also be that you have a connection with arc or railway lines from some other generator which is " swinging," i.e., the lines are being blown or knocked together at intervals by wind or some moving object. We would suggest that you put a volt-meter between the socket and ground. If it show a voltage higher than that of the secondary circuit, and steady, you may be certain that your cross is either in the transformer or else in the wiring of that particular building, and should be easily discovered by a visual inspection. If the voltmeter reading is unsteady your cross is swinging, and as the secondary system is not likely to extend far from the building it should not be hard to find. If the foregoing does not serve to get you over the difficulty, if you will write more fully we will be able to go more in detail into the question.

PUBLICATIONS.

The third edition of "Alternating Current Phenomena," by Chas. Proteus Steinmetz, has just been issued by the Electrical World and Engineer, of New York. This work is intended as an exposition of the methods which have been found useful in the theoretical investigation and calculation of the manifold phenomena taking place in alternating current circuits, and of their application to alternating current apparatus. In the third edition several new chapters have been added, such as those on vector representation of double frequency quantities as power and torque, and on symbolic representation of general alternating waves. Many chapters have also been revised. The new edition contains upwards of five hundred pages, is amply illustrated, and sells at four dollars.

On October 17th the Mayor of Brockville, Ont., on behalf of the town, formally took over the electric and gas plants.

A SUCCESSFUL METHOD OF LIGHTNING PROTECTION.

Readers of the Electrical News will be interested in particulars of the somewhat remarkable experience of the Royal Electric Company of Montreal in connection with means adopted to protect from lightning their long distance transmission lines between Chambly and Montreal. These lines are about 17 miles in length each, of which 14½ miles is aerial, the remaining 2½ miles being composed of three sections of cable : the first section being about a mile and a half from the power house, the second section 15 miles from the power house, and the third section leading into the sub-station in Montreal.

Simultaneously with the construction of the pole lines, the company strung three barb wires to protect the transmission wires from lightning. This barbed wire lightning protection consists of three double strand No. 12 wire, with four barbs about every five inches apart. One of the three wires is placed on a pin, and a glass insulator on the top of the poles, the remaining wires are placed on ordinary glass pony insulators on the ends of the top cross-arm. Each of these wires are connected by means of a soldered joint to the ground wire running down the pole, this ground wire running through a one inch wrought iron pipe 8 ft. in length to the bottom of the pole, and after passing through the pipe, wrapped several times around the butt of the pole. The ground wire and pipe were placed on the pole at the time the poles were erected. The poles are 90 ft. apart and the barbed wires are connected to a ground wire on each pole. The grounding of the barbed wire every 90 ft. is considered one of the most important points in the protection.

It was originally intended to protect these transmission lines by means of banks of lightning arresters, but the lines were put into use before the company were able to procure the requisite number of lightning arresters. It was intended in the event of a severe storm to disconnect the lines until such time as the storm was over, in the meantime operating from the local station in Montreal, it being considered unwise to expose the transmission lines and cables and generators connected thereto to any possible destructive effect from lightning discharges from the transmission lines.

The first storm occurred about midnight, when it was practically impossible to transfer the system, and the company was apprehensive that the cables or step-down transformers or generators connected to the transmission lines might be punctured by destructive discharge. However, the storm passed, without any damage being done to the transmission lines. This seemed to indicate that barbed wire was very good protective device, and when the next storm occurred it was thought advisable to risk possible damage from lightning, inasmuch as the lightning arresters were not then procurable.

Time passed, and the entire summer with the numerous severe storms, had gone before the lightning arresters were available. By that time it had been conclusively proved to the satisfaction of the management that the barbed wire was an effective and efficient lightning protection. Since that time it has been entirely relied upon to protect lines in lightning storms. As an extra precaution, however one bank of lightning arresters was placed at the power house, but they are not regarded as necessary.

One particularly severe storm which occurred caused a great deal of damage to the company's property in Montreal. Noticing that the storm was travelling directly towards Chambly, the general superintendent put himself in communication with the power house by means of his private telephone and kept close track of the storm, which arrived at Chambly, 17 miles distant, about three-quarters of an hour after it had burst over Montreal. The company's lines and transformers in Montreal were considerably damaged, and two local distribution lines at the Chambly end were also damaged, but not a single discharge occurred on the two transmission lines, each 17 miles in length. During one entire season, without any lightning protection whatever with the exception of the barbed wire, there occurred no discharges from the 34 miles of transmission lines, although during the summer season there were numerous very severe thunder storms, which caused considerable damage on local lines that had not been protected by means of barbed wire. The barbed wire has been placed on glass insulators for the purpose of protecting it at the points where it is supported. One of the dangers to be apprehended from the use of barbed wire is its rusting and rubbing to such an extent that it becomes weak and breaks. The Royal Electric Company have not yet had a single barbed wire strand break, but they are giving this phase of the question considerable attention. The means sometimes employed for supporting barbed wire, that of connecting it to the top of the poles or cross-arms by means of staples, is thought to be productive of unsatisfactory results.

An exchange of opinions and experience by central station managers on this important subject would be welcomed by our readers, and is therefore invited.

MOONLIGHT SCHEDULE FOR NOVEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 11.50	A.M. 5.30	5.40
3....	A.M. 1.00	〃 5.30	4.30
4....	〃 2.00	〃 5.40	3.40
5....	No Light.	No Light.	...
6....	No Light.	No Light.	....
7....	No Light.	No Light.	....
8....	No Light.	No Light.	....
9....	P.M. 5.15	P.M. 8.30	3.15
10....	〃 5.15	〃 9.30	4.15
11....	〃 5.15	〃 10.30	5.15
12....	〃 5.10	〃 11.30	6.20
13....	〃 5.10	〃 0.30	7.20
14....	〃 5.10	A.M. 1.30	8.20
15....	〃 5.10	〃 2.30	9.20
16....	〃 5.10	〃 3.30	10.20
17 ...	〃 5.10	〃 4.30	11.20
18....	〃 5.10	〃 5.30	12.20
19....	〃 5.10	〃 6.00	12.50
20....	〃 5.10	〃 6.00	12.50
21....	〃 5.00	〃 6.00	13.00
22....	〃 5.00	〃 6.00	13.00
23....	〃 5.00	〃 6.00	13.00
24....	〃 5.00	〃 6.00	13.00
25....	〃 6.00	〃 6.00	12.00
26....	〃 7.00	〃 6.00	11.00
27....	〃 8.30	〃 6.00	9.30
28....	〃 9.30	〃 6.10	8.40
29....	〃 10.30	〃 6.10	7.40
30....	〃 11.40	〃 6.10	6.30
		Total.........	224.55

The Bertram Engine Works, of Toronto, will install electric light plants on new boats now being built, and have given an order to the Canadian General Electric Company for two 25 k.w. direct connected direct current generators.

By a vote of 190 against 75 the ratepayers of Almonte, Ont., have just decided in favor of raising $30,000 for the establishment of a municipal electric light plant. A similar by-law submitted to the ratepayers one year ago was defeated by a majority of 38.

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Correspondence is invited upon all topics legitimately coming within the scope o this journal

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Electrical Development in Montreal.

THE growth of electric lighting and power in the city of Montreal is astonishing. It is learned that, during the last four years the number of lights in use in that city has increased from 54,000 to 100,000. The Royal Electric Company have also in operation over 5,000 horse power in motors. Users of these motors have contracted with the company to run the machines only between the hours of 7 a. m. and 4 p. m. Thus the power load is entirely a day load, and does not in any way interfere with the lighting load. Between the hours mentioned the day load averages between 80 and 90 per cent. of the lighting load, a condition that is believed not to exist elsewhere in the world.

Electricity on the Farm.

THE employment of electrical energy for agricultural purposes has received considerable attention in Europe, and particularly in some parts of Germany. Near Ochsenfurt, in Bavaria, a company has been organized for the establishment of a large water power plant for the generation of electricity to replace animal power on the farms in the vicinity, the current to be distributed from a central station by means of sub-stations. Nearer home, however, we find an application of electricity for agricultural purposes on the Dentonia Park farm of Mr. W. E. H. Massey, situated but a short distance from the city of Toronto. Mr. Massey has installed in a unique power house an electrical plant for lighting and power purposes. There are twenty-six buildings on the farm which are lighted electrically. The plant includes a storage battery system capable of supplying 200 lamps for five hours. It is the purpose to operate the machinery on the farm by electric power. In a future issue we hope to publish an illustrated description of this plant.

Questions and Answers.

REPLIES to several problems pertaining to steam and electrical engineering will be found in the Questions and Answers Department of this issue. It is the hope of the publishers that liberal use will be made of this Department by our readers. If properly taken advantage of it should prove one of the most interesting features of the journal. Every effort will be made to give satisfactory answers to questions propounded. Our views will not, perhaps, in all cases, meet the approval of every reader. Those who may differ from our opinion are offered the free use of the Department to give their solution of any problem. It is in the widest discussion that the many interesting points can best be brought out and the most benefit derived to the student in the various branches of engineering. This Department should be of special benefit to superintendents and operators of steam and water power electric plants, in whose daily employment incidents are certain to arise concerning which they will require enlightenment. We ask the assistance of our readers in maintaining and broadening the influence of this Department.

The Growth of Electrical Engineering.

IT is gratifying to learn that the opportunities in the electrical business appear to be enlarging to such an extent as to attract many of the brightest young men in our leading scientific schools. In McGill University this year there are thirty fourth year students in the Engineering department. Of this number eighteen, or sixty per cent., are taking the electrical course. The Electrical department is now taxed to its utmost capacity, and, notwithstanding the great improvements which have been made in this department during the last five years, the University authorities are now confronted with the problem of providing still greater accommodation, both as regards extra space and additional appliances. It is learned that a considerable proportion of the young men who have passed through this department have succeeded in securing positions of responsibility and at satisfactory remuneration. Quite a number are yearly absorbed by the electrical manufacturing companies, while others have found positions in the United States where the demand for highly trained men is much greater than in Canada. In this country also the number of important electrical enterprises is rapidly increasing, and with it the demand for young men with a scientific education.

Street Lighting in Toronto.

THE question of street illumination is just now engaging the attention of the city council of Toronto. For this purpose both electricity and gas are now employed. The existing contracts expire on January 1st next. Tenders were recently invited for a renewal of the contract from that date. That the Council might be in a position to judge with some accuracy of the merits of the tenders submitted, two experts were appointed to report on the various forms of street lighting apparatus embodied in the tenders. There were submitted for their investigation by the Toronto Electric Light Company, nine types of lamps, three by the Kitson Hydro-Carbon Heating & Incandescent Lighting Company of Cleveland, four by the Carbon Light & Power Company of Philadelphia, and three by the Consumers' Gas Company, of Toronto, in all nineteen different forms of apparatus for street lighting. The tests were made in the School of Practical Science, and were conducted under conditions similar to those employed by a committee of the National Electric Light Association which reported at its recent meeting in Chicago. Judging by their original report, the experts appear to have made a somewhat comprehensive investigation, and their deductions seem to be in favor of the electric light. Their task was not an easy one, as there is no universally recognized basis of comparison between different lamps. The report shows that the maximum candle power of the open arc lamp under the conditions of the specifications is 1,119, and of the same lamp under paesent conditions 1,674. The maximum candle power of the Kitson lamp, which burns oil, is given as 907, while that of the hydro-carbon vapor lamp and of the ordinary gas lamp is much below these figures. The experts were apparently undecided as to the respective merits of the electric light, the Kitson lamp and the hydro-carbon lamp with special reflector. Following the original report, they submitted to the Council a supplementary document. This, while purporting to assist the Council in their task of deciding upon the most advantageous method of lighting, is to our mind rather contradictory and misleading. In it a statement is submitted of the comparative cost of lighting in the case of each form of apparatus by two methods of comparison, first, the price of one candle power, and secondly, the annual cost per mile of street illuminated in such a way that in each case the light midway between the lamps would be the same. For the purposes of this comparison the experts assumed an illumination equal to that produced by one candle at ten feet on a surface held so as to be best illuminated at that point. In the first column, which is the cost per candle, that for the open arc lamp is given as 10.71 cents, the Kitson lamp 11.08 cents, and the ordinary hydro-carbon lamp 89.9 cents. Looking at the second column we find that the cost per mile of illumination is given as $974 for the open arc lamp, $789 for the Kitson lamp, $1,387 for the ordinary hydro-carbon lamp, and $731 for the hydro-carbon lamp with special reflector. It seems strange that, while on the basis of cost per mile such a favorable showing is made for the hydro-carbon lamp with special reflector, the cost of candle power should have been omitted in respect to this particular type of apparatus only. The casual observer would probably conclude that on the basis of cost per mile the hydro-carbon lamp was cheaper than the electric light. It is unfair, however, to calculate on the basis of per mile of illumination, particularly with the special reflector, which throws most of the light in one direction, as most of the lights on the streets of Toronto are on street corners and diffuse light north, south, east and west. Another peculiarity of the report is that the point of illumination at which the tests were made was the minimum for the electric light and approximately the maximum for the gas light. Under the method of estimating, the electric light at its weakest point was equal to the gas light, but at every other point infinitely superior. This extra and increasing light at every other point than the minimum was not taken into account at all. The question as to which form of lighting should be adopted seems to be at once solved by a comparison of the tenders submitted. On account of lamps being located at intersections of streets, whether the arc lamp or the oil lamp is employed the same number of lamps will be required. The tender for renewing the present contract for electric lighting, with a lamp of the highest efficiency of any submitted to the experts, is $65.70 per lamp per year. Calculating on the basis of 1,000 lights, there would be a saving to the citizens of $25,000 per annum by the adoption of the electric light.

The Automobile Field.

THE automobile is with us, and without doubt to stay, and we are assured upon all hands of the benefits to be derived therefrom, not only on the score of cheaper transportation, but in the matter of cleaner streets, better roads, etc. These things are true and obviously so, but one great change which will inevitably be brought about by the introduction of the automobile has not attracted the attention it deserves. Up till about twelve years ago passenger transportation in the cities was in the hands of the horse-car companies, while intercommunication between cities was entirely by steam. At the present steam transportation is decreasing for interurban short distance work, and its place is being taken by the electric road; the old horse-car systems for urban transportation are entirely superseded by the electric. These are days of rapid changes, and another change will take place within the next few years which will place the electric urban road where the horse-car road is now. For city work the great desiderata are rapid, frequent, flexible and cheap service, and the present electric systems have these advantages over the older horse-car systems, for which reason the latter have been displaced. The demands for these advantages to a more marked degree are increasing, and that mode of transportation which will fulfill these conditions to the maximum possible will inevitably prevail. In the automobile we have something at hand which will give at least as frequent and rapid service, and will certainly be more flexible in meeting demands than the present electric lines for city service. As regards the cost of transportation, a little consideration of the elements which enter into the question will be necessary to form a judgment. Assuming that automobile bus-lines were initiated and run in competition with the electric cars, what would be their advantages from the point of view of operating costs. The largest item in the cost of electric transportation is generally that of motormen and conductors. This would probably not be decreased, nor would car inspection or repairs, by the use of the automobile. The next largest item is the fixed charges for interest, depreciation, taxes, etc. These depend upon the investment, and very slight consideration will readily convince the most skeptical of the smaller capital cost of the automobile. The electric line has a station costing about $100 per h.p., a permanent way valued at from $10,000 to $50,000 per mile, depending upon the nature of the structure and whether the paving is included, which is often the case ; overhead construction costing from $2,000 to $10,000 per mile ; cars and equipments from $2,500 to $4,000 each ; and in addition probably a percentage of receipts is demanded by the municipality for the franchise. The franchise also has to be obtained at frequently great cost and trouble. Against this, in favor of the automobile, no franchise is required, no permanent way, no overhead construction is needed. The busses will cost no more than the cars at the worst, and no station will be required unless the system be storage battery automobiles, and if required will be much less costly than for the electric cars both in total cost for the same traffic and for operating costs, the reason being that the station will be running at its full capacity at all times, thus requiring a smaller horse power of plant and having that plant operating at its highest efficiency at all times. In the case of steam or gasoline machines, no station whatever would be required. The busses would run upon any street and would never be blocked by interruption to the supply of power, street repairs, etc., and could be concentrated to meet sudden demands in a manner not approachable by the electric cars. Under these conditions the final triumph of the automobile for city transportation appears certain, the electric roads to be restricted to the interurban services where advantages may be had of greater speed over their own right of way than would be permissible in the case of an automobile line traversing the country highways. It may be questioned whether automobiles will be available for winter service in such places as Montreal and Quebec, and the point will be well taken at the present time, but those who predicted the use of electric cars in those places ten years ago were laughed at, and it may safely be predicted that the winter difficulties will be overcome as were those of the electric cars. As to the system of propulsion adopted at the present time, it would appear that steam would be the cheapest, but has the disadvantage over electricity of being more noisy and complicated, and for many reasons apart from cheapness electricity has the most to commend it. A further advantage of the automobile bus line lies in the fact that the public will be guaranteed a fair competition with consequent reduction in fares, as no monopoly can be granted as is done at present. The automobile is in the same position as regards the city business as the electric roads were about ten years ago, and the next ten may see as great a change in this regard as the last.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building.

MONTREAL, November 6th, 1900.

Fifty-two volt lamps, and apparatus generally fo rthat voltage, will, so far as Montreal is concerned, ere long be a "thing of the past." The Lachine Company serve at 110 volts, and all new connections made by the Royal Company are at 104 volts ; in fact, this latter company are gradually changing old 52 volt installations over. The Imperial Company are doing the same as the Royal. This in many instances will be beneficial, as there is quite a number of houses wired for too great a percentage of loss.

It is amusing to read in convention discussion that the Quebec Legislature are not "sharks," like the Ontario one, in regard to electrical taxation, etc. Give them time ; they are on better "pay streak" at present, but just as soon as they find that a few dollars can be squeezed out of electrical industries, they will "get there" quick enough, and it is easy betting that they will leave their Ontario confreres "miles behind." The Montreal City Council are at the present moment scheming around as to how they can best have a good "crack" at it.

According to the Inspection Department, there are over 40 firms (sic) doing construction work (interior wiring) in Montreal. Who they all are and how they manage to eke out a living (if they do, are questions that would puzzle a Philadelphia lawyer. Variations of 300 per cent. have been noticed among tenders, i.e., by those parties mean enough to take a dozen or so of tenders, and who generally scheme to get a reliable firm to accept the figure offered by the unreliable. The remedy here is an old, though slow one, "The survival of the fittest."

Mr. Robertson, E.E., on the occasion of his marriage lately, received a very handsome present from the staff and fellow employees of the Royal Electric Company, in the shape of a handsome oak case of cutlery. Mr. Robertson was completely taken by surprise. It may do him good to know that he is held in equal esteem by those in the trade generally, as well as by his fellow employees.

On the occasion of the formal opening of the Royal Victoria College for women, by Lord Strathcona and Mount Royal lately, the evening's illumination of the building was striking. The outlines of the college were all picked out in incandescent lamps, and in several places heraldic shields, set with appropriate colored lamps, were hung. The work was placed in the hands of the Royal Company, and executed under the supervision of Mr. J. A. Douglas, superintendent of the interior wiring staff.

How strange it is that if one were to choose to go about Montreal electrical supply houses, he would be able to get four or five prices on regular standard supplies, and yet if one went from the east to the west of the city he would not find a variation of a fraction of a cent. in purchasing say a pound of sugar, loaf of bread, or yard of cotton. This surely is not as it should be, and ought to be easily remedied if the dealers would get together and talk the matter over.

It is to be regretted that the old and tried city surveyor of Montreal, Mr. P. W. St. George, C. E., has had to tender his resignation, being simply driven out of his position, I understand, by unfounded charges made by an incompetent and grossly unjust Road Committee. Such treatment is, however, on a par with usual municipal management here. The question interests certain of the local electrical fraternity, as the permission for location of poles is vested with the city surveyor, and it is ten chances to one that we will have a successor who will try to do his duty in a just and conscientious way, as Mr. St. George has done.

THE BREMER ARC LAMP.

THERE have been many attempts at treating arc-light carbons by impregnation and in other ways, which have had the effect of making the arc burn more quietly and imparting a somewhat better color to the light, but no striking results have heretofore been achieved.

But according to some tests made by Herr W. Wedding, whose experiments are recorded in the Elektrotechnische Zeitschrift, and summarized by the Engineering Magazine, a decided advance has now been made by Herr Bremer, who prepares carbons containing from 20 to 50 per cent. of non-conducting salts of metals, such as calcium, silicon and magnesium.

The first measurements made were of a continuous-current arc lamp taking about 12 amperes. The positive carbon was the only one specially treated, and it contained a calcium compound. In the article just mentioned are given tables and curves of illumination at various angles with the horizontal, from which it appears that when no globe was used, the mean hemispherical intensity of the light was 4,320 candles. The average current through the lamp during the run was 12.3 amperes, the mean electro-motive force 44.4 volts, so that the average power used was 546 watts, or 0.126 watt per candle.

The same lamp with a globe had a hemispherical intensity of 2,772 candles and used 543 watts, or 0.196 watt per candle.

The second lamp tested is similar to one now hung on the Eiffel Tower, in Paris, at an elevation of 95 meters. It has four arcs, takes about 60 amperes of continuous current, and the positive carbons contain a calcium compound, as before. On account of the great intensity of the light the tests had to be conducted at night and in the open air. The lamp was hung 8 meters above the ground, and the illumination was measured on a surface 1 meter from the ground and at different distances from the lamp. From the observed results it was found that the maximum intensity of the light when no globe was used was 83,000 candles, at an angle of 37 degrees below the horizontal, while the mean hemispherical intensity was 49,730 candles. The average current was 55.8 amperes, the electromotive force 89.3 volts, so that the power used was 4,980 watts, or only 0.1 watt per candle. When covered with a globe, the hemispherical intensity of the light was found to be 26,890 candles, and the power used 4,610 watts, or 0.17 watt per candle. From the above figures, it appears that for the arc lights without globes the power used was hardly more than 0.1 watt per candle. Herr Wedding states that the lowest power consumption he had ever found with other kinds of lamps was 0.3 watt per candle, and that the average was between 0.4 and 0.5 watt. The new lamp, therefore, is three times as efficient as the best of the old ones, or, putting it another way, with the same power three times as much light is produced.

An alternating-current arc lamp with one of its carbons treated by the Bremer process was measured without a globe and found to have a mean intensity of 512 candles and to use 0.5 watt per candle. This shows a decided improvement on previous alternating-current arc lamps, and it is believed that with better construction even more favourable results can be obtained.

The regulating mechanism, which works smoothly, is much simpler than in the ordinary kinds of lamps, but the details are not yet ready for disclosure. In the ordinary lamps most of the illumination comes from the glowing carbons, but in the new lamp the arc itself furnishes considerable light, and so makes a more even distribution of illumination. Above the arc and surrounding the upper carbon is a conical tin hood, which helps to retain the heat generated in the arc and also acts as a reflector. Some of the products of combustion settle on the inner surface of this hood in the form of a pure white powder which makes an admirable reflecting surface and helps in the even distribution of light, so that the lamp globe, when on, appears uniformly illuminated and the upper half is not in the shade, nor are sharp shadows of the negative carbon and its holder cast on the lower hemisphere.

Favourable photometric measurements alone do not make a lamp successful. Much depends upon the æsthetic impression which the light makes on the eye, and in this respect the new lamp is not wanting. The large amount of calcium contained in the carbon gives rise to a rich yellow-red radiation, in contrast with the usual bluish-violet rays of the arc, so that the light has a much warmer tone. According to the inventor, the colour of the light can be regulated at will by varying the composition of the carbons.

The richness in red rays of the Bremer lamp led Herr Wedding to try some experiments to determine how well it could penetrate fog and mist. He took a lamp of the ordinary kind and a Bremer lamp and interposed a cloud of steam about 1 meter thick betwen them and a photometer. Repeated observations showed that the penetration of the new light was twice as great as that of the old. This result points to the applicability of the Bremer lamp to lighthouses and signal lights where the penetration of fog is of consequence.

PERSONAL.

Mr. J. W. Marr has been appointed electrician for the Toronto Evening Telegram building.

Mr. Albert Courtney has been engaged as superintendent of the electric light plant at Walkerton, Ont.

Mr. W. R. Miller has been elected a director of the Montreal Telegraph Company to fill the vacancy caused by the death of Mr. Henry Archibald.

Mr. Jos. H. Ward, late electrician for the Grimsby Electric Light Company, is now head engineer in Messrs. J. Cobbledeck & Son's mill at Exeter, Ont.

Mr. C. W. Dill, assistant city engineer of Nelson, B. C., recently tendered his resignation, and has been engaged as superintendent of construction in connection with the municipal power development at Bracebridge, Ont.

Mr. John Hudson, president of the American Telephone & Telegraph Company, successors to the American Bell Telephone Company, died very suddenly at Beverley, Mass., October 31st. For over 20 years deceased had been closely connected with the Bell Telephone interests.

Mr. Ezra Good, who held a responsible position in the works of the Canadian General Electric Company at Peterborough, was tendered a complimentary banquet by the employees of the company a few days prior to his departure from the town. Mr. Good carries with him in his new field the best wishes of many friends.

Mr. C. J. D. Baby, late chief accountant of the Cataract Power Company, of Hamilton, and now assistant manager of the Packard Electric Company, St. Catharines, was presented before leaving Hamilton with a solid silver tea service by the officers and staff of the Cataract Power Company. The presentation was made by Mr. Gordon J. Henderson.

At the recent convention of the American Street Railway Association, which opened in Kansas City on October 17th, the following representatives of Canadian roads were in attendance: C. E. A. Carr, manager, and E. R. Carrington, of the London Street Railway Company; M. Powers and J. M. Smith, of the Toronto Railway Company; C. K. Green, manager, and J. B. Griffith, purchasing agent, of the Hamilton Street Railway Co.

Mr. F. B. Brothers, formerly manager of construction for the Montreal street railway system, but who for the past year has been superintending the construction of an electric railway in Georgetown, British Guiana, returned to Montreal a few weeks ago. His visit, however, was of short duration, as a fortnight ago he left for Cuba in the interests of The Cuba Company, of whch Sir William Van Horne is president. Mr. Brothers will assume charge of the construction of several hundred miles of steam road. The work will be on a most extensive scale, and it is expected that 3,000 men will be employed.

Mr. Charles Tollington, representing the Bagley & Wright Manufacturing Company, cotton spinners and manufacturers, Oldham, England, was a recent visitor to the office of the ELECTRICAL NEWS. Mr. Tollington's headquarters are in Montreal, his company having established a Canadian branch at 318 St. James street in that city. The company are introducing to the Canadian trade their covering for electric wires. Having had many years' experience in the manufacture of cotton, they claim to be in a position to furnish just what is required for electrical purposes. It is possible that the company may establish a branch in Toronto.

Geo. S. Munro met death in the Brant hotel, at Brantford, by coming in contact with a live electric wire.

The London & Vancouver Finance & Development Company give notice of their intention to build a tramway from a point on the Chemainus river to the town of Chemainus, and to operate telegraph and telephone lines in connection.

The Incandescent Lamp

By H. D. Burnett.

THE following interesting paper pertaining to the development of the incandescent lamp was read on October 23rd at the second semi-monthly meeting of the Peterborough Engineering Club by Mr. Henry D. Burnett, superintendent of the lamp department of the Canadian General Electric Company.

The present year marks the close of the second decade in the history of the commercially successful incandescent lamp. The closing twenty years of the 19th century have witnessed a development of electrical industries that, in the magnitude of interests involved, capital invested, employment of labour, and display of inventions, presents no parallel in the world's history. The invention of the modern incandescent lamp, about 1880, was probably the principal factor in causing this wonderful development of electrical machinery and general appliances. The incandescent lamp having become an accomplished reality, there sprang up a greatly increased demand for the electric dynamo for supplying current to such lamps, and with increased use a vast amount of scientific skill and ingenuity was applied to its development and to enlarging its field of usefulness.

A great number of subsidiary electrical appliances became necessary; switches, cut-outs, measuring instruments and other station equipments, together with distributing systems, etc. After the establishment of a net-work of wires throughout each large city for the supply of current to the lamps, it was a natural and easy step to devise electric motors that could be run by the current from the same lighting circuits. And the wave of electrical invention spread with increasing rate of speed from year to year, until to-day we witness a display of electrical machinery as applied to nearly all branches of arts and industries that is simply marvellous.

This paper has to deal with an apparently insignificant example of the application of electricity to one of the very useful arts, that of supplying light. The magnitude of the incandescent lamp industry to-day is best understood from the fact that no less than 25,000,000 lamps are manufactured and consumed yearly, and the consumption is rapidly increasing. The importance and commercial value of this little transformer of energy may, perhaps, be appreciated by the fact that it has probably been the subject of more prolonged, obstinate and expensive patent litigation than any other subject or article in the history of inventions.

The invention of the incandescent lamp is, in America at least, almost universally ascribed to Thomas A. Edison, who received his fundamental or basic patent from the United States' patent office, Jan. 27, 1880. This first important patent bearing upon the Edison Carbon Filament Lamp was applied for two months earlier, in November, 1879. This, then, may be taken as the date of birth of the modern incandescent lamp, and to Edison, undoubtedly, is due the credit of being the first one to produce a practical and commercially successful incandescent lamp. But it is a popular error to assign to him the credit of being the first or original inventor of an incandescent lamp. There are many who, no doubt, would be surprised to learn that over thirty years before Edison ever started to experiment in this line, there were incandescent lamps made and patented that consisted of a carbon burner contained in a glass bulb from which the air had been exhausted, which burners were made incandescent by passing the electric current through them. This description to many a casual observer might be considered as describing the present incandescent lamp, so familiar to us all.

Prior to November, 1879, when Edison applied for his celebrated carbon filament lamp patent, there had been produced no fewer than twenty different incandescent electric lamps, by as many different investigators, including English, French, American and Russian, most of which were patented, and all of which differed from each other in more or less important details. The first of these, having a platinum wire for the incandescent part, was patented by Frederick de Moleyns in 1841. It is certain that from that date up to 1879 there was a great deal of attention given to this subject of the incandescent electric lamp. It may then be of interest, now that the smoke of this memorable legal battle has cleared away, to consider for a few minutes the questions: Who was the real inventor of the incandescent lamp? What was the important step in the prolonged series of experiments that brought about a successful lamp? To what extent is Edison entitled to being called the "Father of the incandescent electric lamp?"

The essential and indispensable elements of the incandescent lamp to-day are as follows:

1st.—A bulb or receiver composed entirely of glass.

2nd.—A vacuum of high degree inside the bulb.

3rd.—A filament of carbon having very small cross section and high resistance.

4th.—Platinum wires passing through the wall of the bulb and sealed perfectly by fusion of the glass about them, for conducting current to the filament.

5th.—Suitable joints or connections between the filament that is to become white hot and the metallic leading in wires that are to be kept as cool as possible.

6th.—A base of any suitable substance secured to bulb and bearing two metallic contracts insulated electrically from each other, and connected respectively to the two wires passing through the glass, this base being for the purpose of entering the socket joined to the electrical circuit.

There has never been a commercially successful incandescent lamp that did not embody in its construction all of the six above named elements. Edison's lamp of 1880 contained every one of these elements. Every incandescent lamp made prior to Edison's experiments had one or more of these elements wanting. There have been various attempts made during the last twenty years to construct lamps lacking one or more of these essential elements, or containing important modifications of these elements as stated. Such lamps have usually had a very short history. They have either been found to contain some inherent defects, or have been unable to compete in the open market with the standard lamp embodying the elements mentioned.

Examples:—Westinghouse "Stopper Lamp" with cement filling. Pollard Lamp with silver powder to replace platinum leading wires; Novak Lamp (no vacuum), said to contain iodine. Found by analysis to contain carbon tetra chloride h cl vapour and c.l. gas with trace of nitrogen. (These types of lamps were shown and described by Mr. Burnett.)

We will now consider some of the earlier types of lamps and note what important elements were lacking in them and stood in the way of their success.

It was an American named J. W. Starr, a resident of Cincinnati, who is entitled to the credit of having produced the first incandescent lamp using carbon for the burner. This carbon, obtained from gas retorts, and in the shape of small pencils or thin plates, was enclosed within a glass bulb to which was attached a glass tube about 30 inches long. The bulb and the tube were filled with mercury and then inverted, allowing the mercury to run out from the bulb, leaving in its place a Torricillian vacuum. The carbon pencil was attached at one end to a platinum wire which was sealed into the top of the bulb, and at the other end to a copper wire which dipped into the mercury. This lamp had not the high resistance filament nor the all glass receiver of the modern lamp. It burned remarkably well for the first attempt in this direction, but the lite of the carbon must have been very short. A chandelier of 26 of these lamps was on one occasion exhibited in public, symbolical of the 26 States of the Union, which display was admired by the great physicist Faraday. This lamp was patented in England by King in 1845. While Star was the first to produce a carbon, vacuum, incandescent lamp, he was not the first to cause carbon to become incandescent by means of the electric current, while protected by a vacuum from combustion. The principle that light and heat could be produced by passing the electric current through poor conductors was well known in the beginning of this century. Sir Humphrey Davy, who in 1800 discovered the phenomenon of the voltaic art, which is reproduced in the commercial arc lamp of to-day, also experimented in the line of producing light from carbon rendered incandescent by the electic current. His vacuum was underneath the bell-jar of an air pump. So far as known Davy did not attempt to apply these principles to a portable incandescent lamp.

The first incandescent lamp was that of De Moleyn's, already referred to, which had a platinum wire for the burner. This was patented in 1841. Then came Star's carbon lamp of 1845, already described. The following year Greener and Staite took out a patent for a carbon lamp similar to Star's. In 1849 Petrie patented a lamp in which iridium was used as the burner. Then followed in succession the charcoal rod lamp of Nollet & Sheppard in 1850, the graphite coke lamp of Roberts in 1852, DeChanzy's lamp of 1857, of which he produced, it is said, 12 lights of great steadiness run from 12 Bunson elements ; Gardiner & Blossom's platinum wire of 1858, and Adam's platinum wire lamp produced in Boston in 1865 but not patented. All of these lamps were little more than laboratory experiments and attained no commercial importance. In 1873 Lodyguine, a Russian physicist, produced a double carbon burner lamp with which he lighted a public hall in St. Petersburg on the occasion of a number of evening lectures which he delivered on the subject of electric lighting. He used nitrogen in his bulb instead of a vacuum. This was a step backward in the art, and beyond some improvements in details, his lamp was no great advance over its predecessors. For his experiments and researches on carbon as a material for such lamps, in which he showed its decided superiority over platinum, he was awarded a prize by the St. Petersburg Academy of Sciences. This lamp started a new list of experimenters on this subject of the incandescent lamp which had lain practically dormant since Star's lamp demonstrated its own impracticability.

Kosloff went from St. Petersburg to France in 1875 and exploited a lamp which he considered an improvement upon Lodyguine's, in that it had a series of carbon rods thrown successively into action as each one burned out.

Kohn, the same year, patented a similar lamp in England, while Khotinsky in France brought out another multiple carbon lamp. He proposed the arrangement of the lamps in multiple arc and provided a key by which to light or extinguish the lamp at will.

The next year, 1876, Bouliguine constructed a lamp with a single long carbon in holders so that only a small section of the carbon was in circuit at one time. When one section burned out another section was shoved up by the mechanism of the lamp.

This same year, 1876, just one year before Edison began his experimenting along this line, Woodward, in the United States, patented a lamp made from a glass tube, hermetically sealed at each end where the wires entered to conduct current to the small sheet of carbon that constituted the burner. The wires, however, were not sealed into the glass by fusion. The lamps were to be placed in parallel on the electric circuit. The lamps were to be first exhausted, then filled with a rarified gas that did not support combustion. This patent was afterwards bought by the Edison Company.

The period from 1875 to 1879 was one of great activity for inventors in this apparently very alluring field of incandescent lighting. I have referred to the work of Kosloff, Khotinsky and Bouliguine in France. In England there were Kon, Scott, Pulvomachear, Vanchoate, Lane, Fox and Swan, while in the United States the subject was being investigated by Farmer, Woodward, Sawyer and Man, and Edison, and I suppose I should also include the name of the now famous Henry Goebel, who was discovered in 1893, about thirteen years after Edison's patent was issued, by the opponents of Mr. Edison, in his famous series of patent suits against infringers. Mr. Goebel claimed to have made incandescent lamps in considerable numbers during the years extending from 1854 to 1880. He passed through the period when Edison's name was heralded throughout the country as the inventor of a successful lamp, which would bring him untold wealth, and yet he never thought of applying for a patent on his own so-called invention, although he was fully alive to the value of patents, for he had applied for one on another invention.

The activity displayed by lamp inventors during these few years, just prior to Edison's success, is, perhaps, illustrated by the fact that a Frenchman named Fontaine found sufficient matter of interest bearing on the subject to induce him to write a book on the incandescent lamp and electric lighting.

Thus, quite contrary to the popular conception of the subject, Edison, the father of the incandescent lamp, so far from being the first producer of such an article, had access to a book on this subject which was issued in 1877, before he began his regular experiments in this line. This book is very interesting, in that it describes some experiments made by the author on the best types of lamps in use at that time, and we are thus made informed of the state of the art two years before Edison's invention of the successful modern lamp.

Fontaine, referring in his book to Kohn's lamp having several carbons, says : "When the receivers are sealed and the contacts carefully put in line the carbons last for a satisfactory period. The first carbon of a lamp never lasts for less than a quarter of an hour, while its average duration is twenty-one minutes. The succeeding carbons last upon an average for two hours, so long as the luminous intensity does not reach forty burners, (equivalent to 380 c.p.), in which case the average duration is only half an hour. The vacuum never being perfect in the receivers, the first carbon is in greater part consumed. It would appear that, consequent upon the little oxygen contained in the lamp being transformed into carbonic acid and carbonic oxide, the carbons should be preserved indefinitely. But there is then produced a kind of evaporation which continues to slowly destroy the incandescent rods." From these experiments it was concluded that there existed this inseparable obstacle to success with carbon as the material for the burner. Note that these lamps tested by Fontaine gave light of about 300 c.p. each. Fontaine appreciated the desirability of obtaining smaller units. He thought that if one lamp on a certain number of battery cells gave 300 c.p. of light, a number of these, say six, arranged in series on same circuit, ought to give 1-6 of 300, or 50 c.p. each, and when he got with this arrangement practically no light from any of the lamps, he could not understand the reason, and after trying also the multiple arrangement of the lamps, concluded that the sub-division of electric light by means of incandescent lamps was an impossibility.

With these lamps described by Fontaine, as well as the ludicrous results of his experiments in the immediate back ground, and with a perspective view of nearly forty years of spasmodic but persistent attempts to produce a practical incandescent lamp, the brilliant achievement of Thomas A. Edison in this well-beaten road, is worthy of our highest admiration. Undaunted perseverance is the distinctive trait in this man's character, to which we are indebted for the incandescent lamp, as well as numerous other valuable inventions connected with his name.

Probably turned aside at first thought by the numerous failures associated with carbon as the material for a burner, he first gave his attention to platinum, as more likely to afford a staple burner or filament. He produced and patented a lamp having, unlike previous platinum lamps, a filament of comparatively high resistance, which was provided with an automatic cut-out for switching out the filament when its temperature reached that point at which there was danger of its melting. This lamp was little more than an electric vibrator, caused by the continuous action of the cut-out device. Undismayed at this failure in this line, he turned his attention to carbon, and after about a year of experimenting brought out his high resistance carbon lamp, of substantially the same type as that in use to-day.

The important respect in which Edison's lamp differed from all previous lamps was that it possessed the long slender carbon of such high resistance as to permit of the divisibility of the light into small practical units. He displayed a wonderful ingenuity in devising means of manufacturing these threadlike filaments, but when he had gone thus far, had he been contented with the means previously used for securing and retaining the vacuum necessary for the preservation of such a filament, he would have met nothing but failure.

He was the first lamp maker to construct the walls of his vacuum chamber entirely of glass, with the glass melted about the wires that carried the current to the filament. This combination, then, of the high resistance threadlike carbon, with the all glass bulb holding a high vacuum, and the conductors passing through the glass, constituted Edison's great invention.

All carbons used in previous lamps were short and comparatively thick, or of large section, making their resistance low, less than five ohms, as compared with Edison's filament of one hundred ohms or higher resistance. This low resistance necessitated large current, and correspondingly large conductors for the current. Large metallic wires are good conductors of heat. Hence the heat was drawn away from the burner and the unequal expansion of the wires and the material about them caused air leak into the lamps. There was not a lamp made before Edison's time that had a practicable seal for retaining a perfect vacuum. There have been numerous attempts in recent years to make so called improvements upon the Edison all-glass globe, sealed by fusion of the glass, but no such attempt has ever been successful in producing a commercially satisfactory lamp. With the modern lamp, having a carbon filament or burner about 1-200 of an inch in diameter, it is of vital importance that there shall be absolutely no leakage of air into the lamp after the lamp has been exhausted. At the very outset of his experiments with carbon for a burner, Edison adopted the only method of sealing or closing the vacuum chamber that has ever been found to be perfectly effective in holding the vacuum of high degree necessary in the incandescent lamp. The lamps exhausted by Edison eighteen years ago have just as good vacuum to-day as he produced in them at that time. I have before me a lamp made by the Edison Lamp Company fifteen years ago, and it now has just about as good vacuum as we produce in our lamp to-day. The marvellous ingenuity displayed by Edison in solving the numerous knotty problems connected, first, with the production of a successful lamp, and secondly, with its economical manufacture, has won the admiration of every lamp expert who has studied the early history of this invention. Even to-day, with all the knowledge of the art of lamp manufacture, coming from a practice of twenty years, it is an exceedingly difficult matter for any manufacturer to turn out lamps in commercial quantities, having a uniform grade of excellence, so exceedingly sensitive in this article to the minutest defect in any part of its construction.

That the problem of its first development was no trifling one is shown by the fact that Edison, with his wonderful fertility and unrivalled energy, spent nearly all his time for six continuous years in developing and perfecting his lamp, its manufacture and his system of lighting. During this time he spent on this work about $100,000, and during these six years took out in the United States alone over eighty patents pertaining solely to the incandescent lamp and its manufacture. In his search for the best material for a filament, he tried every substance that he could procure in the animal, vegetable and mineral kingdoms. He sent special envoys to South America, Central America, West Indies, China, Japan, India, and elsewhere, in search for a suitable fibre, and finally adopted for this purpose a certain selected growth of a particular variety of bamboo found in one of the inland districts of Japan. Of this material only a selected portion, that immediately below the outer skin, was found suitable.

Strange to say, after twenty years of experimenting with all kinds of materials, natural and manufactured, there are lamps of certain classes being made to-day out of this same grade of Japanese bamboo that are superior to lamps having filaments made of any other material designed for the same purpose.

To illustrate Edison's remarkable perserverance and capacity for work, there were times when for two weeks he never left his laboratory to go to his house, which was but a short distance away.

On one occasion, in Newark, when a certain printing telegraph machine failed to work to his satisfaction, he locked himself up in his room with five assistants, it is said, and declared he would not leave until he had made it work, and work it did, although it required sixty hours continuous labour.

Let us now consider briefly the improvements that have been made in the incandescent lamp during the twenty years of experimenting and commercial manufacture. The bulb has changed only in shape. The first bulbs used by Edison were blown from glass tube. Then came the free blown bulb obtained from the glass works, which was used for eleven years by the Edison Lamp Company, which has always been by far the largest lamp manufacturer in the world.

For the last eight years the moulded bulb has been used almost exclusively by all lamp factories. The method of sealing the bulb to make it absolutely air tight is practically the same now as it was twenty years ago. The vacuum obtained by Edison in his early lamps was just as good as that produced to-day by those lamp factories that exhaust their lamps by the use of mercury pumps. The Ebison Lamp Works in the States, and the Canadian General Electric Company's Works at Peterborough, are using an improved chemical method of exhausting, which gives not only a superior vacuum to that obtained by the mercury pumps, but also a far more uniform grade of vacuum in all the lamps. Edison required six hours to produce his vacuum. To-day we produce the same in less than one minute. The shortest time required by mercury pumps is about one-half hour.

The filament used by Edison in his first experimental carbon lamp was made from carbonized paper, but this very soon gave place to bamboo, and this material was then used exclusively by the Edison Company for all classes of lamps up to 1894. The Sawyer Man Company, as well as the Thomson Houston Company at Lynn, also used the same material, while other companies were using carbonized silk and cotton thread, and a few amorphous cellulose. This last mentioned material has been used by all the principal companies during the last few years. It is very much cheaper to work than bamboo, is more homogeneous and better adapted to make the long thin filaments necessary for low candle power lamps.

The principal improvements in the quality of the lamp during the last twenty years have been on the filament, and pertain chiefly to improvements in the method of treating or flashing the carbon base, whereby a hard, dense grey coating is deposited upon the surface of the filament. The method employed in making this deposit of dense carbon determines largely the life of the lamp, the maintenance of its candle power and efficiency, and the uniformity of product as to voltage and power consumption. This operation of treating the filament is now performed by automatic apparatus designed to break the electric circuit at the instant when the hot resistance of the filament has reached the desired point. All lamp manufacturers use the process of treating. So that whatever the material used in making the filament, whether bamboo, silk, cotton thread, or cellulose, it is in all cases given a very similar surface coating, all factories using for this purpose some of the various forms of hydro-carbon.

They all keep as secret as possible the various details of their methods of manufacturing this part of the lamp, and the difference in the quality and behaviour of different makes of lamps is traceable chiefly to the different methods of preparing the filament and handling it throughout the several stages of its manufacture.

The process of treating the filament in order to make the surface coating, which I have mentioned, is one of the most beautiful and interesting phenomena in the art of electric lighting. The carbonized thread, already shaped like the filament, is inserted in a bottle from which the air is then exhausted. The bottle, by means of valves and pipes, is then placed in connection with another bottle containing one of the many forms of hydrocarbon liquid, such as gasoline, and the vacuum above the liquid causes it to evaporate rapidly and fill the treating bottle with hydro-carbon gas or vapor. The electric current is now sent through the filament, causing it to become incandescent, as it does when in the finished lamp. This vapor, coming in contact with the white hot filament, is chemically decomposed or broken up into its constituent elements, and a pure carbon, similar in nature to graphite, is deposited on the surface of the filament base, which is also almost pure carbon but of less dense structure and resembling wood charcoal. This operation of artificial growth or enlargement of the filament continues until it has attained the proper electrical resistance, when the current is cut off and the filament is removed from the bottle. The filaments need to be designed of such size and length that when the treated coating has attained the proper thickness, the resistance of the filament will be from 30 to 50 per cent. of the resistance before treating, the per centage varying with different classes of lamps. The time required to make this deposit varies in different cases from a few seconds to half a minute, and longer in some special cases. The resistance of the filament, when in the treating bottle, falls very rapidly since the deposited carbon has about one-sixth to one-tenth the specific resistance of the base carbon.

The most beautiful phenomenon in connection with treating the filament is that of rendering it perfectly uniform in resistance and brilliancy throughout its length, provided the treatment is continued a sufficient length of time. This action will be best understood by reference to a diagram and a little supplementary explanation.

Very strange to say, this process of treating the filament, so essential to the highest quality of lamp, was invented and patented before Edison had produced his first successful carbon filament lamp.

The patentees, Sawyer and Man, although four years ahead of Edison in the production of a carbon burner lamp, would probably never have had any commercial use for their process of treating, and probably would never have appreciated its immense importance and value, had there not been invented a commercially successful high resistance carbon lamp to which the process was more perfectly adapted. Had Edison applied this treating process to his perfected bamboo filament, for which he would have been obliged to pay royalty to Sawyer and Man, he would have produced a lamp twenty years ago that on test by the most severe of modern methods, would have compared very favourably in all respects with the best lamp made to-day.

Edison knew that his competitors could not make a successful lamp without infringing on his own patents, and he did not propose to be indebted to any other individual in the manufacture of a successful commercial incandescent lamp which he considered his own, and his greatest invention. He therefore set at work to discover some other means of accomplishing the same result

He concocted a fluid in which he dipped his bamboo filaments prior to carbonizing, and by this means did effect a great improvement in the material, but the process was by no means equal to the treating process. Edison, with characteristic shrewdness, kept his process of preparing the filament a secret, and to make doubly sure that those engaged in manufacturing the lamps would not become acquainted with the filament process, had this work done under his personal supervision at a small shop several miles away from the lamp works. For about twelve years the Edison Company used this dipping process of preparing their filaments in place of the hydro-carbon treating process. Many of you are no doubt familiar with the old Edison lamp with glossy black filament, which would start at 16 c. p. with an efficiency of 3.1 watts per candle, and in less than 100 hours would be down to 12 c. p. with an efficiency of four or more watts per candle, and the decline in candle power and efficiency continued until, at the end of three or four hundred hours, the candle power was perhaps ten and the power consumption five or more watts per candle. Do you wonder, then, that these lamps after this gave very long life? And yet, you will run across a man now and then, even to-day, who will declare that the lamps made to-day cannot compare with the good old Edison lamps of ten years ago.

When the treating patent expired the Edison Company hastened to abolish the old Edison dipping process, and for the last eight years they have been treating all their filaments with the exception of those used in their 200 to 250 volt lamps, which are not treated, because it is impracticable to make treated filaments of sufficiently high resistance and of sufficient mechanical strength and sufficiently small surface to be used at such high voltage, and give as low as sixteen candle power.

I may add, however, that the treating process is not so necessary with the cellulose squirted filament as it was with the bamboo, since the former is much more homogeneous and uniform in section and surface than was the bamboo.

The lamp with untreated filament will decline in candle power much more rapidly than the treated filament designed for the same candle power, voltage and efficiency. For candle power, maintenance and useful life, the 200 v., 16 c. p. 4 watt lamp with untreated filament stands about midway between the 110 v., 16 c. p., 3 1-2 and 3.1 watt treated filament lamps.

I have now considered the changes that have been made during the last twenty years in the bulb, the vacuum, and the filament. There remain the three important elements, the leading in wires for carrying the current to the filament, the joints between those wires and the filaments, apparently insignificant but very important, and the base of the lamp for attaching it to the circuit.

For leading in wires platinum is used now, the same as it was by Edison, but the quantity used per lamp has been greatly reduced. There have been various attempts to substitute other cheaper metals for the expensive platinum, but none have proved commercially successful.

For joints Edison used a copper wire which was welded to the platinum at one end, and at the other flattened and bent about the carbon filament and finally copper plated. This was very effective and was used for many years, but the use of copper at the joint is somewhat detrimental to the quality of the lamp. At present the principal companies use a carbon paste for attaching the filament directly to the platinum wire. This is not only better, but cheaper than Edison's method.

The base used by Edison is used to-day with but very slight and unimportant modifications. There have been two dozen or more distinct types of base designed by different lamp companies that have started up during the last twenty years, and I have always admired the practical genuis of Edison who, in this, as in many other ways, hit upon just that form, that after twenty years of experimenting on the part of rivals, has survived nearly all other forms of bases and is to-day not only the best but also the simplest and cheapest to manufacture.

Having considered the most important movements that have been made in the incandescent lamp during the last twenty years, I will now treat very briefly of the present method of lamp manufacture. As most of you have probably visited our lamp works, you are already familiar with the main mechanical processes, and I will not need to dwell upon these.

The filament is made from cotton in its original state. This is first thoroughly cleansed and then digested with chemical ragents until it is reduced to a gelatinous state resembling glue. After standing some length of time it is put into a mechanical mixer and thoroughly churned, then strained and exhausted to remove all air bubbles. It is then introduced into a special bottle containing a very small circular aperture or die in its lower neck, and by means of compressed air on top of the mass it is squirted through the die into alcohol, which causes it to coagulate into a white thread, which after being washed is wound onto a drum and allowed to dry, when it very much resembles horse hair. This is gauged and sorted, wound unto suitable forms to give it the filament shape, and then subjected to the baking process. The filaments are placed in graphite crucibles, surrounded by graphite or other material to exclude the air, and then gradually raised in a furnace to a very high temperature, sufficiently high to melt iron but not platinum, and so held for several hours until all the volatile matter is removed from the filament in the shape of gases. When removed from the furnace, the filaments are almost pure carbon and very smooth and glossy. They are now ready for the next process, treating, which has been described.

EFFECT OF SCALE IN BOILERS.

THE commonly accepted idea is that the efficiency of a steam boiler is seriously affected by an accumulation of scale. Perhaps the most often quoted estimate is that the presence of 1-16 in. of scale causes a loss of 13 per cent. of the fuel burned, ¼ in. 38 per cent., and ½ in. 60 per cent. Recently, says the Street Railway Review, we have seen published statements tending to show that the loss of efficiency due to scale has been greatly over-estimated.

Prof. R. C. Carpenter, of Cornell University, writing in the American Electrician, says that so far as he is able to determine by tests a lime scale, even of great thickness, has no appreciable effect on the efficiency of a boiler. A test which he conducted when the boiler was thickly covered with lime scale showed practically as good results as when it was perfectly clean. The explanation is that the heating capacity is affected principally by the rapidity with which the heated gases will surrender heat, as the water and metal have capacities for absorbing heat more than a hundred times faster than the air will surrender heat. Any deposit which curtails slightly the capacity of absorbing heat on the water side has very little effect either on total capacity or efficiency. A thin film of grease, however, being impermeable to water, keeps the latter from the metal and generally produces disastrous results.

Mr. Walter M. McFarland, formerly an engineer officer in the United States Navy, in the course of a lecture at Sibley College, Cornell University, stated his experience had been that a considerable thickness of clean uniform scale made apparently little difference in the efficiency of the boiler. On the U. S. S. Vandalia there were two boilers used for distilling water, and the water evaporated per pound of coal was no more when the boilers were clean than after three months when the scale was nearly ¼ in. thick.

On the other hand, there are recent tests showing that scale does reduce the efficiency. In May and June, 1898, Prof. L. P. Breckenridge, of the University of Illinois, made tests on a locomotive boiler before and after cleaning it of scale and found that the loss due to the scale was 9.55 per cent. The average thickness of this scale was 3-64 in.; analyses of samples taken from different points in the boiler showed from 20 to 67 per cent. calcium carbonate and from 4 to 40 per cent. calcium sulphate.

Also, copies of reports of tests sent us by the Union Boiler Tube Cleaner Co., of Pittsburg, show that there is a marked increase in the efficiency of the boilers after the scale has been removed. In one case the gain was 16.3 per cent. and in another 24.8 per cent.; the thickness of the scale was not stated.

FREE SCHOLARSHIPS.

The trustees of the American School of Correspondence, 156 Tremont street, Boston, Mass., have decided to depart from custom in their policy of promotion. Believing that a personal exposition of the advantages of a school is often better than, or at least, a great help to printers' ink, they have announced their willingness to grant a limited number of free scholarships to men in various large establishments and parts of the country. We are not advised of the exact conditions, but anyone who thinks he would like to have one is invited to correspond with them, giving his occupation, and his application will receive consideration by the trustees. The school calls attention to its coures in mechanical and electrical engineering (including a complete course in mechanical drawing), the former including steam, locomotive and marine engineering. As its work is confined to these branches, they point out the probability of better work being done than would be likely where many other branches are taught.

BY THE WAY.

THE manager of a gas company in one of the leading cities of Canada is having built a new residence in a choice residential district where electricity is almost universally used for house lighting. He complains of having been pestered by electric wiring firms desirous of securing the contract for wiring his new house. The idea had not occurred to these enterprising contractors that it would never do for the manager of a gas company to light his house by electricity. When so informed they gave the gas manager a look expressive of their deepest sympathy with a man who was prevented by circumstances from adopting up-to-date methods.

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In the past great difficulty has been experienced in wiring, for electric light, without damage, residences which are decorated. Wiring men have been obliged to abandon the idea of getting to outlets and switches located on brick walls without channelling. The firm of Strickland & Company recently contracted to wire a large residence in Toronto for some two hundred lights, and in many cases switches and wires had to be located on solid brick wall. They devised a means of overcoming the difficulty and carried out the work successfully. They have baptized the tool used in the work a "persuader," and it is certainly a useful article.

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AT the recent meeting of the British Association some very interesting experiments were performed in firing cartridges by means of electric waves, sent out from an apparatus arranged for wireless telegraphy. In this case it was an apparatus similar to Signor Marconi's that was used, and it was intended to have fired the cartridges from a balloon that was sent up from the Lister Park, where the members of the British Association were being entertained, but the balloon got away so quickly that communication was lost with it before the experiments could be carried out, and to satisfy the scientists the gentlemen in charge of the apparatus fired the charges by imitating the wave that would have arrived from the balloon if the communication had been maintained. The arrangement consisted of the usual coherer which is necessary for inductive wireless experiments, and a wave was sent to it through the wooden wall of the hut in which the apparatus was placed, by means of the spark of an ordinary frictional electrical gas lighter. The action of the wave on the coherer caused an electric relay to operate and to connect a battery of accumulators with the wires leading to the fuse, which exploded immediately the current passed. In the opinion of a writer in the Colliery Guardian there are possibilities in this that may be useful in mining.

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AT the recent convention of municipal electricians, held in Pittsburg, a humorous communication was read from Mr. L. J. Morgan, formerly city electrician of Kansas City, in which he explained that the office of city electrician in that city had been abolished. Referring to some of the conditions under which the city electrician labors, Mr. Morgan said that "his employers consisted chiefly of the mayor and a city council, or probably the city council and a mayor. Characteristic curves of the mayor may be more or less easily plotted, but no one can foretell the vagaries of the city council. The ethics of the profession," he continued, "demand that dignity should be omnipresent, but dignity and aldermen are strangers. In vain you attempt to discuss with an alderman plans which you have for bettering the electrical condition of the city, or money that you have saved by the elimination of electrolytic electrolysis. The alderman dismisses such a proposition with a gesture and brings you down to earth with a jar by telling you that he has a friend whose door-bell doesn't work or that his electric-light meter is working over-time. If he doesn't want a door-bell fixed or his meter shunted, he probably wants a city telephone placed in his hall or a city arc lamp in his parlor, or perhaps he only wants his gasoline stove repaired. When the influential member introduces you to his brother-in-law and confides to you that he is to be your chief or sole assistant, that he is a first-class kalsominer and in a few days will learn to be a good electrician, you must cheerfully accept this as an axiomatic proposition. Never show the slightest annoyance ; if you don't like him take him out and connect him up with the alternating-current primaries. This is not crime, but philanthropy. Endorse unreservedly any and every proposition advanced by any member at any time or at any place. It is also wise to express an eagerness to personally assault any person, not a councilman, who has the slightest views opposed to those of the aforesaid member."

ELECTRICAL EQUIPMENT OF THE CHAMBLY PLANT.

The initial installation at the works of the Chambly Manufacturing Company, at Chambly, from which point current is transmitted to the city of Montreal, 17 miles distant, consisted of four two-phase generators of 2,000 k.w. capacity each, wound to generate current at 12,000 volts. The plant was so designed, however, as to provide for the installation of eight machines of the above capacity. The demand for power has been such that the Chambly Company have found it necessary to install the additional equipment originally provided for, and we are informed by the Canadian General Electric Company that they have secured the contract for four generators of 2,000 k.w. each to complete the installation. These will be wound for 2,200 volts, and by means of transformers the current will be stepped up to 12,000 volts for distribution over the circuits.

ELECTRICITY ON GERMAN FARMS.

Under date of August 23, 1900, Consul Hughes, of Cobourg, says : "In this and neighboring parts of Germany, considerable attention is being paid to electrical appliances that can be used on the farm. Near Ochsenfurt, in Bavaria, a company composed of landowners and small farmers has been organized for the establishment of an electrical system for use on their farms and villages. The current is to be generated by steam and water and to be distributed from a central station to the places at which it is wanted. Sub-stations are to be established at given points, with the necessary apparatus for connecting with the farm or other machinery, and also for lighting purposes in the houses, offices, roads and village streets."

The negotiations with Boyd & Company to operate the electric light plant at Huntingdon, Que., by water power have been declared off. The plant will be run by steam until next spring, when steps will be taken by the town to acquire a water power.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

FOURTEENTH DINNER OF TORONTO NO. 1.

A jolly party assembled in the large dining room of the Walker House, Toronto, on Thanksgiving eve, to partake of the fourteenth annual dinner tendered by Toronto No. 1, C.A.S.E. The attendance numbered about one hundred and fifty. With one large table at the head of the room and ten smaller tables, prettily decorated with plants and flowers, a splendid effect was produced. Seated at and near the head table were ex-Mayor Shaw, Messrs. James Huggett, president Toronto No. 1; G. C. Mooring, executive president; R. C. Pettigrew, Hamilton, past executive president; Chas. Moseley, executive vice-president; A. M. Wickens, executive secretary; G. F. Haworth, of Sadler & Haworth; J. J. Main, Canadian Heine Boiler Company; G. R. Baker, Westman & Baker; W. C. Powers, traveller Vacuum Oil Company; G. W. Grant, Hamilton-Grant Oil Company; J. M. Sinclair, Eureka Mineral Wool Company; E. J. Philip, The Steam Specialty Company; A. E. Edkins, J. W. Marr, W. P. Sutton, O. P. St. John, W. J. Webb, H. E. Terry, George Thompson, James Bannon, W. C. Blackgrove, Wilson Phillips, and others.

The menu was tempting and served in good style. Their appetites appeased, attention turned to the toast list. As presiding officer, Mr. James Huggett welcomed the guests to the fourteenth annual banquet. In his remarks he pointed out that the engineers were banded together to raise the standard of the profession. This was the sole object of the Association. The secretary, Mr. Marr, read a letter of regret from City Engineer C. H. Rust. "The Queen" being honored, the president asked the guests to rise and drink the health of "Canada, Our Home," to which ex-Mayor Shaw responded in a truly patriotic speech. It was not only the material prosperity of Canada that we should be proud of, but fame had come to our country through the gallantry of the Canadian soldiers in South Africa. He concluded with the remark that our destiny must be with the Motherland.

Mr. A. M. Wickens responded to "Toronto, Our City." Toronto, he said, was the center of the educational institutions of Canada. Perhaps it was not generally known that we have the only free technical school in the world. He, as one who had always taken a deep interest in technical education, hoped that it would soon be possible to furnish the scholars with free books as well as free tuition, and that the Toronto school would be the forerunner of many technical schools throughout Ontario.

The names of Messrs. G. R. Baker and J. J. Main were coupled with the toast of "The Manufacturers." Mr. Baker said that when we look back we must admit that the manufacturing industries had improved within the last four years. He was not one who believed that the introduction of new machines and ideas would decrease the demand for labor. When he started in business they had no planing machine, but used the hammer and chisel. He said that as good mechanics could be found in Canada as anywhere in the world. In calling upon Mr. Main, the president referred to him as one always ready and anxious to help the engineers. Upon rising Mr. Main was heartily applauded. He said that it had been his privilege to be present at eleven of the fourteen banquets which had been held by Toronto No 1. It was also his good fortune never to have had bad times. His trouble had been more work than he could possibly turn out. Recently he had received enquiries for machinery from all parts of the Dominion. Boiler-making, he said, had undergone wonderful changes. A few years ago, when the riveting machine was introduced into the boiler shop, the boiler makers threatened to strike; later pneumatic machinery was introduced, but still there was plenty of work for the men. In his opinion no capable boiler-maker need be out of employment. Mr. Main in closing acceded to a request for a story, the telling of which was roundly applauded.

"Educational Interests" was acknowledged by Mr. E. J. Philip and Mr. A. M. Wickens. The C.A.S.E., Mr. Philip said, had done more to educate its members than any other society. It was the intention of Toronto No. 1 to hold open meetings during the coming winter, at which instructive papers would be read. Mr. Philip referred to the fact that the stationary engineers were in a large measure responsible for the establishment of the technical school. While a course in the technical school was to be commended, another source of education which gave good results was the correspondence schools. A Canadian correspondence school had been started and would be in good running order before the end of the year, and the intention was to cater largely to the needs of engineers. The advantages of this method of education was that students did not require to leave their homes at night, and that older men, who might not be in a position to keep up with the younger students in a class, could regulate the course to suit their ability. Mr. Wickens, in responding, gave a brief history of the objects of the association. There were two associations, the Ontario Association and the Canadian Association. The former is incorporated by the Government to grant certificates to competent engineers, while the latter aims to educate the engineers so that they may obtain these certificates. During the coming year it was proposed to take a further step in educational work. Last year five different lesson papers were issued to active members only, but at the last convention funds were set apart to get out 1,000 copies per month, for twelve months. The object of the papers was to teach engineers how to handle their plant economically. The papers would take up such subjects as water, steam, gases, combustion, temperature, etc., and would be distributed to members and other engineers through the proprietors of steam plants. In this way steam users would get educated regarding the work of the association. Mr. Wickens urged engineers to endeavor to improve themselves, pointing out that there was plenty of room in the engineering trade at the top.

In responding to the toast of "The Executive" Mr. Mooring pointed out that the motto of the Association was safety, reliability, economy, and intelligence. He said that at the last session of parliament they were promised that the legislation asked for would be granted next year. Ald. Pettigrew, of Hamilton, made a brief speech in reply to the same toast. He was pleased to say that the association was growing, and that the Hamilton association, since the last executive meeting, had taken in half a dozen new members. Mr. Chas. Moseley paid a high tribute to Mr. Henry Carscallen, M.P.P., of Hamilton, and Mr. Thos. Crawford, M.P.P., Toronto, for the assistance which they had given the engineers in their efforts to secure legislation.

Mr. O. P. St. John and Mr. A. E. Edkins responded to "Sister Societies," and Mr. James Huggett to "Toronto No. 1." Mr. Huggett stated that open lectures would be given in Engineers' Hall, 61 Victoria street, every third Wednesday in each month, and he extended an invitation to all engineers to attend them. The Association had a good library and was working earnestly to improve the standard of the engineering profession. "Our Host" and "The Press" being toasted, the proceedings of the evening ended.

Mr. James Huggett,
President Toronto No. 1, C. A. S. E.

An excellent programme of songs was furnished by Messrs. Gillogly, Maguire, Anderson and Trowman.

The dinner committee consisted of Messrs. Jas. Huggett, J. W. Marr, W. L. Outhwaite, W. J. Webb, S. Thompson, Jas. Bannon, A. M. Wickens, H. E. Terry, John Fox, A. A. Storer, and G. C. Mooring.

MR. JAMES HUGGETT.

Mr. James Huggett, president of Toronto No. 1, was born at Chatham, Kent, England, and at the age of fourteen years entered the Royal Navy Dock yard at that place, remaining there until he reached the age of twenty-one, when he left for Canada. He has resided in this country ever since, and has occupied several important positions in steam engineering. For twelve years he was in the employ of A. S. Whitting, of Oshawa, leaving there ten years ago to accept the position of chief engineer and mechanical superintendent for the Freehold Loan & Savings Company, whose office building at the corner of Victoria and Adelaide streets is one of the best equipped in Canada. A short time ago the Freehold Loan & Savings Co. was amalgamated with the Canada Permanent & Western Canada Mortgage Company. Mr. Huggett, however, retained his position, and in addition became mechanical engineer of the various buildings controlled by these amalgamated interests. Mr. Huggett has always taken an active interest in the work of the Canadian Association of Stationary Engineers, and his election as president of Toronto No. 1 is a well deserved honor.

The British American Corporation, who are operating their mines electrically, have placed a contract with the Canadian General Electric Company for a 100 h.p. induction motor. This is in addition to several large motors previously installed. The C.P.R. smelter at Trail have also purchased a 150 k.w. motor.

ELECTRIC RAILWAY DEPARTMENT.

STORAGE BATTERY--ITS USE ON SMALL ROADS.

By B. B. Van Nostrand.

The application of storage batteries to the generating system of large electric roads has been described by many engineers in a variety of ways, so that an impression has been left upon many minds that it is only with these larger systems that the battery scheme is feasible. This idea is incorrect, and I think that the following description of the equipment and operation of the Peekskill Lighting and Railroad Company will bear me out in the statement. In the description of this road we shall see conditions that apply in a general way to most small lines.

This road was placed in operation in June, 1899, since which time it has been running without any interruption except momentary stops caused by the circuit breakers flying out. Beginning at the station of the New York Central Railroad, which is at the western edge of the town, near the Hudson river, the road proceeds in a practically straight line through the center of the town and on to Lake Mohegan—a total distance of 4¾ miles. The road is an exceptionally hilly one, in fact the fairly level portions are the exception, and are never more than 1,600 feet long. Beginning at the New York station terminus, the road, as far as grades are concerned, is about as follows: Starting into town, there is 1,000 feet of 7½ per cent. grade—with a small portion (say 20 feet) where it reaches 9 per cent. For a distance of about 4,000 feet beyond this, there is a gradual grade, varying from 5½ per cent. to 2 per cent., terminated by 300 feet, of 5½ per cent. to 7½ per cent. At the top of this is a short level, leading into a 2,000 feet 2 per cent. incline, followed by 1,600 feet, varying from 4½ per cent. to 8¾ per cent., which is in turn followed by 2,000 feet of 3¾ per cent. of up-grade. There is after this a depression, represented by 1,400 feet of down-grade, varying from 6.8 per cent. to nothing, which, after passing into a short level rises 1,400 feet up-grade with a maximum of 4.6 per cent., to another short level. Then follows another down-grade of about 1,800 feet, varying between 8 per cent. and 2 per cent. This is followed by 1,600 feet of level—terminated by 300 feet of 8 per cent. After this is 1,000 feet of level, passing into a short down-grade of 6 per cent., 1,300 feet of level is after this, passing into 2,000 feet of 7½ per cent. The final portion to the end of the road is about 800 feet level.

On this entire line of single track, with four turnouts, 56-lb. T-rails are used throughout, these being laid in the usual manner.

There is a single-track branch 4,000 feet long extending from the New York Central station north to the State Camp Ferry. This operates but one month of the year, at which time two cars are in service.

The overhead construction of the system is simple—consisting of 00 trolley throughout, with 0000 feeder, extending to within ½ mile of the lake end and 1,000 feet from the station end. The branch has no feeder. The 0000 feeder is tapped at regular distances throughout its length.

The apparatus for operating the road consists of one 60-k.w. Edison bipolar 575-volt, 880 r.p.m. generator, belted to a horizontal 13-in. x 12-in. Armington & Sims simple engine, the horsepower of which is about 100 at 575 r.p.m. Belted to this same engine, in tandem with the dynamo, is a four pole differential booster, which is used to render the charging and discharging of the battery automatic.

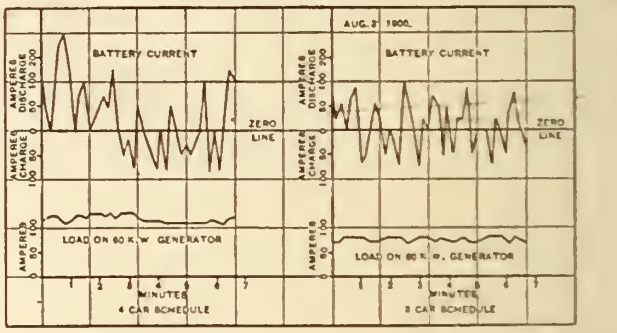
There is another unit consisting of a Westinghouse 120 k.w., multipolar 625 r.p.m. generator, belted to a vertical 14-in. and 24 in. x 14-in. Westinghouse compound engine of 200 h.p. capacity. It may be added here that this generator is rarely used, and that only when the road is unusually heavy—such as occur on holidays and warm Sunday afternoons. The same engine which operates this generator is also belted to one of the alternators for incandescent lighting. It may be well to note that in addition to the above engines there are three other engines which operate the remaining light machines. These, of course, have nothing to do with the railway system. In the boiler room are three 80 h.p. and 100 h.p. horizontal return and tubular boilers, carrying steam at 105 pounds pressure. During the summer months two of the 80 h.p. engines are sufficient to run the entire plant—though three become necessary in winter.

The battery, which is in the simple wooden shed next the boiler room, consists of 26 type F-9 chloride accumulator cells. Each cell is comprised of nine plates, 10½ inches square, suspended in glass jars of sufficient size to enable the capacity to be increased in future by the addition of more plates. Each cell is mounted upon a wooden tray filled with sand, to ensure an even foundation for the jar. These trays rest in turn upon glass insulators, supported by a wooden battery rack. On full charge the battery has a maximum rated capacity of 160 amperes for short periods. As a matter of fact, however, it is often called upon to discharge at a considerably higher rate than this, 250 amperes being called for momentarily.

During the summer season three cars are run from 6 a.m. to 12 p.m. Two of these run through Peekskill as far as the car house at the eastern edge of the town. The other car runs through the town and on to Lake Mohegan. This gives a twelve-minute schedule in town, and forty-eight minutes through to the lake. In the afternoon and evening four cars are run, giving a twelve-minute schedule in town and twenty-four minutes through to the lake. On holidays, etc., five cars are run, all going through—thus maintaining a twelve-minute schedule throughout the run.

Having gained a fair idea of the nature of the system, we will pass to the results obtained in the station.

The point of first importance is the remarkable constancy of the load upon the generator, and the correlated fact that the 60 k.w. machine is all that is necessary to operate the road, except when running the five-car schedule. The curve marked No. 1, in the engraving will explain this. This shows the results of ten-second readings, taken upon the battery and generator during a short portion of a four-car run. The total line current is, of course, the summation of these two. It is seen that this total current fluctuates between 25 amps. and 310 amps., and that the generator runs along at practically full and constant load—the battery assuming the fluctuations above and below this. Curve No. 2 shows the same results for a three-car run. Here the average or generator load is lower (about 75 amps.), and the line fluctuates from 0 amps. to 170 amps. The practical good of this is evident. It means that a 60 k.w. machine is running instead of 180 k.w., which would be required were the battery not in service. In other words, although the load fluctuates from almost nothing to 180 k.w., the average is in the neighborhood of 60 k.w., and it is this average only which falls upon the generator and engine. The remarkable evenness of the load upon the generator produced by the operation of a storage battery is shown very nicely by the fact that we are operating our 120-k.w. railway machine and one of the alternators for our electric lights from the same engine. Ordinarily this would produce a very serious flickering in the lights, but in our case it is impossible to detect the slightest change in the brilliancy of the lamps, although the railway may be fluctuating between its widest limits. I have not had an opportunity to test the coal saving produced by this arrangement, but I am confident from my observations that it is sufficient to pay a good return upon the battery investment over and above the interest and depreciation charges.



No 1. No. 2,

The increased economy of a small unit operating at a full and constant load above that of one three times the size, but doing the same work under highly fluctuating conditions, is such as to warrant this assumption.

It would be difficult to increase the simplicity of operation in this plant. After the original adjustment, the apparatus has worked together without the slightest difficulty. We have a generating unit operating under electric lighting conditions, due to the fact that the battery removes from the systems all sudden overloads, and the strain thus removed from the minds of those in charge is in its effect almost as valuable as this latter consideration.

In other ways the battery is valuable. A great many times it has been necessary to shut down the small engine suddenly from some mishap. During the eight or ten minutes necessary to get the other unit into operation the battery has carried the entire load.

Then, too, it is often desirable to run a car for some special occasion very late at night. At such times the generator is shut down and the battery thrown across the line.

In conclusion, I may state that the battery has given us absolutely no trouble since its installation, and the daily labor for its proper care does not average more than one-half hour. In fact, about all the work required is that of taking voltmeter and hydrometer readings upon the individual cells once each week.

THE MONTREAL STREET RAILWAY.

The fortieth annual meeting of the Montreal Street Railway Co was held in Montreal on November 7th. The report of the directors of the past year's business showed a net profit of $647,-246.64, as compared with $630,870.61 for the previous year. The operating expenses, it was stated, showed an increase of 1.11 per cent. as compared with last year, this increase being due to more frequent and extended car service, increased expenditure for snow clearing, and increased cost of fuel and general supplies, as well as labor.

The company's rolling stock was increased during the year by the addition of 56 closed motor cars, 45 open motor cars, one stores car, 7 supply cars, and 80 trucks, while 128 motors and 83 controllers were added to the electrical equipment of the cars. There are at present under construction in the company's shops six extra long closed motor cars, mounted on double trucks, making in all 25 cars of this type which will be available for service this winter.

The system of cast-welding rail joints was continued and extended, the experience obtained during the past two years fully justifying the expense incurred.

Paper read before the New York State Street Railway Association, Buffalo, Sept. 18, 1900.

TRADE NOTES.

We have received from Messrs J. E. Rhoads & Sons, of Philadelphia, a handsomely printed and illustrated catalogue of one hundred pages, descriptive of their leather belting and factory fire extinguishing appliances, etc.

Mr. L. Sapery, of the Syracuse Smelting Works, Montreal, who has recently returned from Europe, reports that he has secured some good orders for their celebrated babbitt metals and Columbia phosphor tin in England and France, which will be filled for the first time from the Canadian works. This the first instance of babbitt metal or phosphor tin being imported from Canada.

SPARKS.

It is stated that the Electric Development Company, of Philadelphia, will open a Canadian office in Hamilton.

The Chambly Electric Company, of Montreal, have installed a 5 h.p. motor to run a 5 ton capacity elevator in the warehouse of F. X. Benoit & Co., flour merchants, Montreal.

The Aylmer Electric & Manufacturing Company are installing a new 3,000 light incandescent generator purchased from the Canadian General Electric Company, being one of their latest type revolving field machines.

The Chambly Electric Company, of Montreal, have received an order from C. O. Beauchemin & Fils to install a complete warehouse telephone system of ten instruments in their warehouse and seven in their printing office. An aerial cable 5000 feet in length will be used between the two establishments.

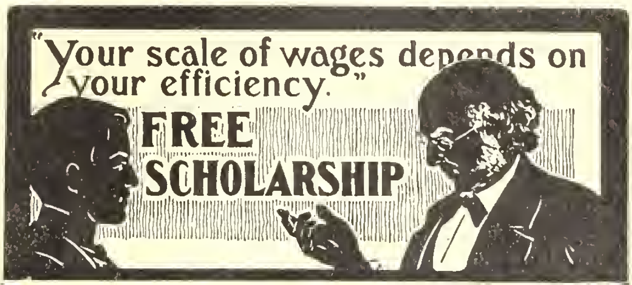
It is reported that the American Bell Telephone Company, the Telephone, Telegraph & Cable Company of America, the Western Union Telegraph Company, and the Postal Telegraph-Cable Company will be consolidated into one big company, to be known as the National Telephone & Telegraph Company.

The electrical equipment of the church of Maisonneuve, P. Q., has gone through many changes. Originally a few lamps were put in, but, considering the advantages of electric light, the churchwardens decided to have a complete plant installed for lighting the entire church. Mr. Valois, manager of the Chambly Electric Company, of Montreal, secured the contract for the installation of a 200 light plant, which was completed in September last.

The Toronto Railway Company have for some time been manufacturing controllers after a patent claimed to be owned by the Canadian General Electric Company. The latter brought suit against the railway company to restrain them from manufacturing the controller, and the courts gave judgment in favor of the plaintiffs, and ordered defendants to pay all costs. The controllers now in use on the road will be continued on payment of damages which have been agreed upon.

The corporation of Lachine, Que., has owned and operated its own electric lighting plant for seven years past. Recently, however, it became dissatisfied with this method, and, after having consulted with Mr. R. A. Ross, consulting electrical engineer, decided to dispose of the plant and accept the offer of the Lachine Rapids Hydraulic & Land Company for the necessary supply of current, which will be delivered at the transformer primaries. The distribution system will be entirely remodelled and adapted for the use of alternating current for light and power.

The Electrical Construction Company, of London, Limited, find their business expanding and growing to such an extent that they have deemed it advisable to enlarge their premises and equip their factory with the latest modern improvements for facilitating the economical and convenient handling of their machinery. They have purchased lots No. 32, 34, 36, 38 and 40 Dundas street west, opposite the court house, 200 feet deep, on which they are erecting a three-story factory. This company have recently extended their business to include fixtures, house wiring, and general electric supply trade, together with several specialties of foreign manufacture. They will, in their new factory, be prepared to handle light and power generators of all sizes and of all requirements. Their factory is being built according to the plans of the so-termed modern machine shop, having travelling crane covering the entire shop, and galleries on each side for the lighter work; the main floor being used for the heavy tools and handling of heavy work. They will be in a position to turn out the very best high grade machinery at a minimum of cost.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SPARKS.

Mr. P. Scanlan has been appointed engineer in the new electric light station in East Toronto.

The New Brunswick Telephone Company purpose erecting a new telephone exchange at St. John, N.B.

Nerlich & Company, of Toronto, are installing a 25 k.w. direct connected generator of the Canadian General Electric Company's type.

Wm. Gray & Sons, carriage builders, of Chatham, Ont., are installing a 350 light plant supplied by the Canadian General Electric Company.

It is proposed to build an electric tramway from Nanaimo, B.C., to the Extension Mines, five miles distant. The road is estimated to cost $150,000.

The plant of the Simpson Knitting Company, of Toronto, referred to in last issue, will include a 500 light direct current Canadian General multipolar generator.

Warden Evans, of Lincoln county, recently headed a deputation which asked the Provincial Government for a charter for an electric railway from Niagara to Port Dalhousie and Queenston.

The shareholders of the Hamilton, Grimsby & Beamsville electric railway have decided to apply to the Legislature for authority to extend their road to St. Catharines, Niagara and Niagara-on-the-Lake.

The Wright Taper Roller Bearing Company is a new Montreal concern applying for a Dominion charter, to manufacture a patent roller bearing for railway cars, bicycles, etc. Mr. W. H. Laurie, of Montreal, is interested.

The Dominion Coal Company, of Sydney, C.B., have contracted with the Canadian General Electric Company for three generators, direct connected to Ideal engines manufactured by the Goldie & McCulloch Company, of Galt.

The Von Echa Company are building an electric railway between Ingersoll and Woodstock, Ont., and have purchased their railway equipment from the Canadian General Electric Company, the intention being to use G. E. 1,000 motors.

Geo. Smith, an electrician of Galt, was killed at Lindsay on October 24th while engaged in the installation of a fire alarm system. Deceased had cut a guy wire, which fell across a live wire, and attempted to remove the guy wire with his naked hands. Instant death resulted.

The Westinghouse generators in the power house on the Canadian side of Niagara Falls were set in motion a fortnight ago. Their capacity is 30,000 horse power. The belts for same were supplied by Sadler & Haworth, of Montreal and Toronto, and include several 44 inches and 24 inches wide, and a number of smaller sizes, each about 100 feet long.

The surveys and plans for the proposed electric railway from Niagara Falls to Fort Erie on the Canadian side have been completed, and preparations are being made to proceed with construction this winter. The road will be constructed along the water's edge, will be 20 miles long and built for fast service. Mr. C. H. Mitchell, Niagara Falls, Ont., is engineer.

The Department of Justice at Ottawa are installing a lighting plant in the St. Vincent de Paul penitentiary. The electrical equipment will be supplied by the Canadian General Electric Company and will consist of one 30 k.w. and one 75 k.w. direct current direct connected generators and a three panel switch-board. The power equipment will be one 50 h.p. high speed simple engine, one 120 h.p. high speed tandem compound engine, and two 75 h.p. boilers, supplied by the Waterous Engine Company, of Brantford.

At the last meeting of the Stamford Township Council Mr. Joseph Battle, of Thorold, asked that the Niagara, St. Catearines & Toronto Railway Company be granted the privilege of building a spur line from a point near the main line and the Stamford-Thorold township line to the Thorold stone quarry. The line will be about two miles in length, and will cost about $9,000. The purpose of the road is to carry stone from the quarries to the main line of the Niagara, St. Catharines & Toronto Railway. It is proposed to be operated by electric locomotives.

An interesting application of electricity for industrial purposes is found in the operation of the plant of the Ottawa Carbide Company at Ottawa. The electrical apparatus was manufactured and installed by the Canadian General Electric Company. A description of the plant would, no doubt, prove interesting to our readers, but this is impossible at present owing to the refusal of the company to allow outsiders to inspect the works. The reason given is that the machinery is said to embody several valuable improvements which have not yet been patented, and new processes in connection with the manufacture of carbide that are known only to the principals of the company. The works are estimated to have cost half a million dollars. Mr. Frank Creelman, C.E., is the consulting engineer.

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SPARKS.

James Donaldson, of Goderich, has made a proposition to the council of Thessalon, Ont., to establish an electric plant for street and commercial lighting.

The Parry Sound Electric Light Company has fixed the value of its plant, which the town may purchase, at $20,000. A by-law authorizing the taking over of the plant will likely be submitted to the ratepayers.

The West Kootenay Power & Light Company, of Rossland, B. C., have secured the contract to increase the power for the Trail smelter by putting in three Wagner transformers of a total capacity of 500 h. p.

The steamship Cowrie recently arrived at London from Koetel, Borneo, a distance of 9,250 miles. The trip was made without coal, liquid fuel being used. Twenty-two tons of oil were consumed daily on the voyage.

The Globe Furniture Company, of Walkerton, Ont., are installing a new 20 h. p. Ideal engine, manufactured by the Goldie & McCulloch Company, of Galt, and a new dynamo manufactured by the Detroit Motor Company.

Messrs. John Parker and H. E. McKee have been appointed arbitrators by the town of Sturgeon Falls, Ont., and the Sturgeon Falls Electric Light Company to determine upon the price at which the electric light plant should be taken over by the corporation.

Sam Lung, a Chinaman, was electrocuted at Peterborough. He went down in his cellar to repair some water pipes, and in so doing lowered an incandescent lamp through a hole in the floor. We are told that in some unaccountable manner he received a death shock from the live wire.

By an error in the notorial deed, some doubts arose as to the time when the contract for street lighting in Montreal expires. The matter was referred to the city attorneys, who have decided that the contract between the city and the Royal Electric Company will expire on December 31, 1903.

The city engineer of Hull, Que., has been authorized to put up immediately 50 arc lights for street lighting. The Ottawa Electric Company will supply the current at $53.53 per kilo-watt. The Adams-Bagnall Company will furnish the lamps, Garrioch & Company, of Ottawa, the wire, and R. E. T. Pringle, of Montreal, the insulators.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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SPARKS.

The Babcock & Wilcox Company, of Montreal, have just shipped a 500 horse power boiler to the British Columbia Electric Railway Company, of Vancouver, B.C.

A 75 k.w. direct connected generator, of the Canadian General Electric Company's make, is being installed by the City Dairy Co. in their new building on Spadina Crescent, Toronto.

The Saugeen Electric Light Company are about to light the towns of Southampton and Port Elgin electrically, and for that purpose have purchased a 2,000 light standard single phase alternator from the Canadian General Electric Company.

A special transformer of 200 k.w. capacity is now being built by the Canadian General Electric Company for the Hamilton Electric Light & Cataract Power Company. It will be used for coverting the current from 22,000 volts two phase to 2,400 volts three phase.

Messrs. Dunsmuir & Company, of Vancouver, B.C., have placed a large contract for electrical apparatus with the Canadian General Electric Company. The British Columbia Railways Company, of the same city, have purchased a 500 k.w. alternating current generator, with switch-boards, from the Canadian General Electric Company.

The Montreal Water & Power Company are about to replace the steam pumping plant in Westmount with an electric pump, which will pump the water from the catch basin in Westmount to the reservoir at Cote des Neiges. This change has been made partly for the purpose of removing complaints by the residents of Westmount of the smoke and noise occasioned by the operation of the steam plant. It is also the intention of the city to put in an electric pumping plant.

The corporation of Morrisburg, Ont., is developing a water power there. The contract for water wheels and steel work has been awarded to the Wm. Hamilton Manufacturing Company, of Peterboro, and that for electrical apparatus to the Canadian General Electric Company, Toronto. The latter contract includes a 200 k.w. revolving field, three phase generator, with switch-board, wire and all necessary equipment. Mr. R. H. Hill, of Toronto, secured the contract for the hydraulic development.

A system of street lighting different from anything in use in this country, is employed in Flint, Mich. From an illustration sent us by Mr. Davidson, of Messrs. Ness, McLaren & Bate, Montreal, we notice that arches are constructed across the principal business streets. On each arch there are fifty lights of 50 c.p. each. These are regulated so that if required only ten of the lights may be turned on. This is said to be the only city in Michigan that is lighted in this manner. The city of Columbus, Ohio, has a similar method, we understand.

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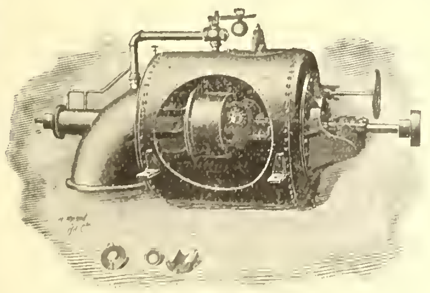

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SPARKS.

It is proposed to make improvements to the street railway system at Sherbrooke, Que.

The Niagara, St. Catharines & Toronto Railway Company have made a survey of the proposed road to Beamsville.

John O'Donohue, of Ottawa, Ont., who was pursuing a course in electrical engineering at the General Electric Company's works at Schnectady, N. Y., was instantly killed in the testing department last month. He was engaged in testing a 400 h. p. generator, and during a period that the power was shut off laid down on a piece of belting and fell asleep. The power was turned on by one of the mechanics at work in the shop and the body was carried to a fly wheel, where it was badly crushed.

The Montreal Street Railway Company have introduced an innovation in street railway building in the reconstruction of their track on St. James street. Steel ties, to which the rails are firmly bolted, are used. The system has been tried in India and various countries in the tropics and is understood to have given satisfaction.

The Paris Electric Light Company are installing a 1,000 light alternator of the Canadian General Electric Company's make.

The Canadian General Electric Company have secured the contract for a 500 light plant for the Sunderland Electric Light Gompany, of Sunderland, Ont.

The St. Hyacinthe Light and Gas Co. have purchased from the Canadian General Electric Co. three 25 light constant current series transformers, and 50 series alternating enclosed arc lamps for the street lighting service in that town.

The Renfrew Electric Light Company, of which Mr. A. A. Wright is president, have placed an order with the Canadian General Electric Co. for a 100 k.w. revolving field, monocylic alternator, to be installed by January 1st next.

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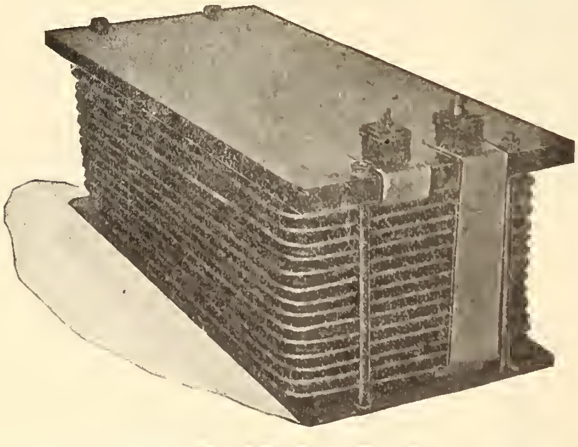

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The new illustrated AUTOMOBILE MAGAZINE (New York : U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press; and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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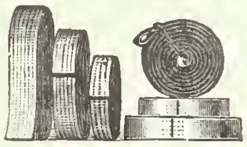

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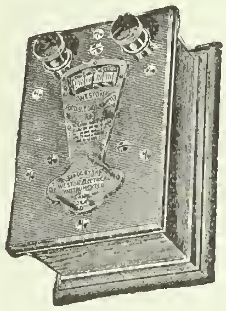

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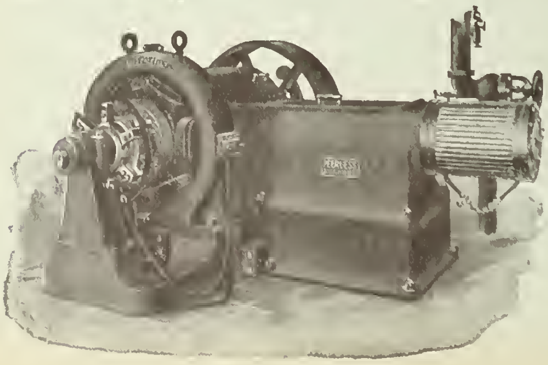

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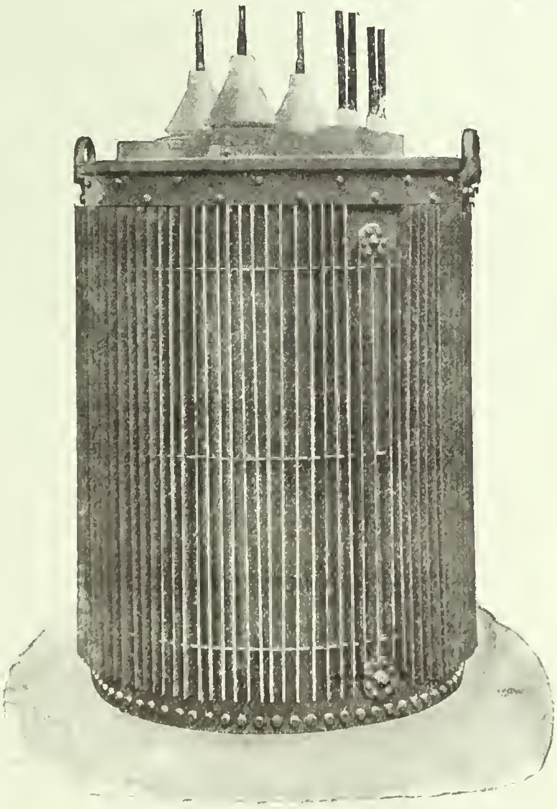

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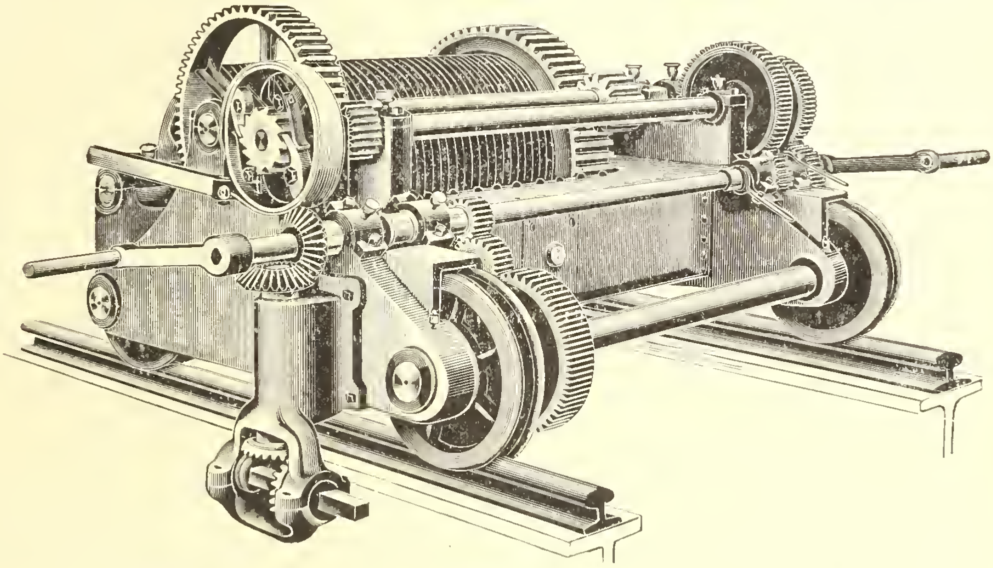

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ELECTRICAL MATTERS IN THE EAST.

[By a Travelling Correspondent.]

In an admirable location, at 72 Prince William street, Mr. R. E. T. Pringle, the well-known dealer in electrical supplies, of Montreal, has opened a branch in St. John, under the efficient management of Mr. G. E. Rough, who is now in charge. The warerooms look out upon the best business street in the city, and are large and well lighted. The main room, which is filled with a complete line of supplies of all kinds, is 30x75 feet. In this Mr. Rough has his office. As Maritime Province agent he will distribute from here, but while doing jobbing, will not contract. His stock includes about everything necessary to the electrical trade, including wire, lamps, transformers, meters, fixtures, shades, etc. A specialty which he is carrying is the Scheeffer meter, for which he claims great success. Mr. Pringle made a good move in opening a branch down here, as it has been greatly needed.

There is little prospect of the street railway in Moncton being opened in the near future, and to my mind, the failure of the concern to make a success in operation should have been foreseen. It never paid running expenses, nor could it be expected to where the one continuous line enclosed but a small block which the public can walk across in a few minutes. Had the line been carried out to some of the small outlying villages there might have been some chance, but these places are comparatively small.

The Moncton civic electric light plant, of which Mr. John Edington is manager, is just putting up a new incandescent circuit of about 1,000 lights. They have two men engaged steadily installing the new lights, and have placed about 500 this summer. They thought of putting in an S.K.C. alternating dynamo, but have given up that idea for the present.

Mr. McGinn, who has been for a long time in charge of the electric lighting station in Fredericton, has resigned and will go on the road as traveller for the A. B. McLean Co., of St. John.

The Robb Engineering Company, of Amherst, whose engines are so widely known, secured an order a week or more ago for a 250 h.p. engine which is to be shipped to Calcutta. Another order is for a portable mill, engine and all fittings of large and heavy capacity which are to be shipped by its purchaser, Mr. Clifford Patterson, to the Chilliwack Valley in British Columbia, where a firm which that gentleman represents is beginning large lumbering operations. The transcontinental freight on this order will be something between $800 and $1,000. The firm has been rushed with business lately.

Another year may see steps taken by the town of Pictou to equip itself with an electric lighting system. Hitherto gas has been used there entirely. Mayor Craig has expressed himself as decidedly in favor of the installation of an electrical plant, and if that gentleman is continued in office the matter will be brought up as an issue next year. The town is now engaged in the securing of an efficient water supply, tenders for which work are about to be asked for.

It is expected that some important changes will soon be made to the electric plant at Springfield N.S.

The village of Oxford, N.S., will soon have a better system of electric lighting than the old one, good as that has been in this thriving little town. The old plant, a small one run by waterpower from a falls in the town, and under the charge of Mr. S. E. Hue, will be done away with. The Oxford Electric Light Co. is putting in a new Royal Electric S.K.C. dynamo of 600 lights capacity, and a new engine of 60 h.p., which has been placed in the engine house of the American Furniture Company, and is supplied by a new boiler of 125 h.p. A large number of electric lights are being added. Among those composing the company are: Messrs. H. C. Hewson, president; Geo. White, secretary; directors, E. G. Langille, A. M. Ross and A. M. Henderson. The Oxford Foundry & Machine Co. have their own lighting plant. The American Furniture Co. will equip their factory with electric lights from the town system.

Parrsboro was the first town in Nova Scotia to put in and operate its own electric light plant, and I am informed that the venture has given satisfaction, and that it is likely to be profitable to the ratepayers as well as to the consumers of light. They are lighting their streets with 25 1200 candle power arc lamps, at a cost to the ratepayers of $600 per year, while the ordinary 16 c.p. light in a dwelling house costs 25 cents per month. Their supply of power and light was found inadequate for the demand, and they are now adding another S.K.C. generator and equipment from the Royal Electric Co. and a Robb-Armstrong engine. This will increase the number of lights by 1,200. They have now 950 lights contracted for, but the demand was so great that they were compelled to add the second power of 1,200 lights that they might be able to supply the town's further demands for more light. Their system, I am told, is all that could be wished for, and the management the best. Councillor Wheaton and superintendent Jules Choisunt have devoted their best efforts towards its success.

A.B.P.

The new lamp invented by Messrs. F. W. Martin and Frank Stewart, of Hamilton, is now being manufactured by the firm of Brown, Boggs & Company, who now have in course of erection a three-storey addition to their factory.

The Gravenhurst Electric Light and Power Co., who were unfortunate enough to have their lighting station destroyed by fire in October, are rebuilding their plant on a more extensive scale, as they have secured the lighting of the sanitarium, which requires an additional capacity of 250 lights. The order for the 75 K.W. S. K. C. generator, with the necessary switchboard, etc., was placed with the Royal Electric Company, and the plant is again in operation.

A. C
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Complete Circuit Series
Lamps with Regulator—.90.

Manhattan Regulating Reactance Coil.

Regulator loss constant at all loads, 200 watts.
Regulators to provide for any percentage of circuit, from 10 to 100 per cent.

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At 6.6 amp., 72-volts, 430 watts. Total loss in lamp, 5 watts
Power Factor .91. Efficiency .90.

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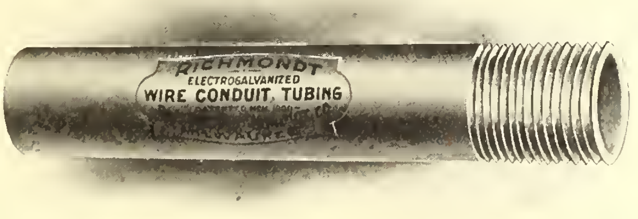

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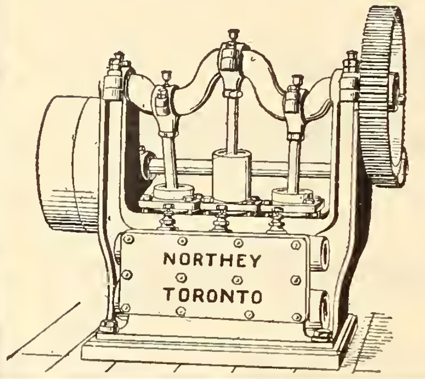

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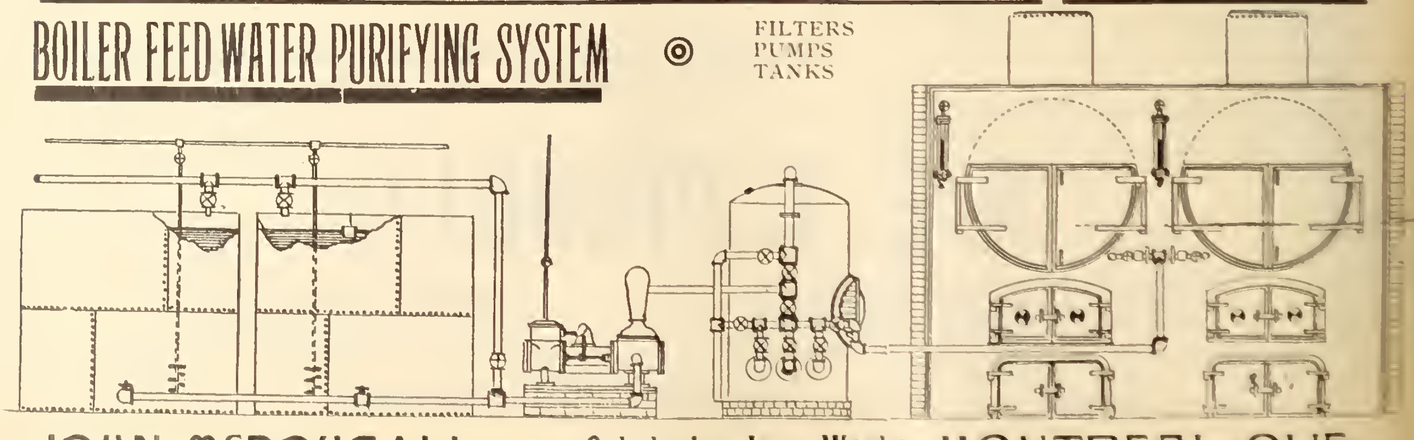

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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. X. DECEMBER, 1900 NO. 12.

ELECTRICAL EQUIPMENT OF McDONALD ENGINEERING BUILDING AT McGILL.

THROUGH the munificence of Sir W. C. McDonald, the authorities of McGill University, Montreal, have been enabled to erect and equip a building for the study of engineering which is one of the most complete institutions of the kind in America. Of pleasing architecture, the exterior is at once admired, while the interior arrangements and equipment command equal praise. The electrical equipment of the McDonald Engineering Building, as it is called, was described at some length in the ELECTRICAL NEWS of May, 1898, but since that time extensive alterations and additions have been made, as will be seen from the following particulars and accompanying illustrations of the equipment as it now stands :

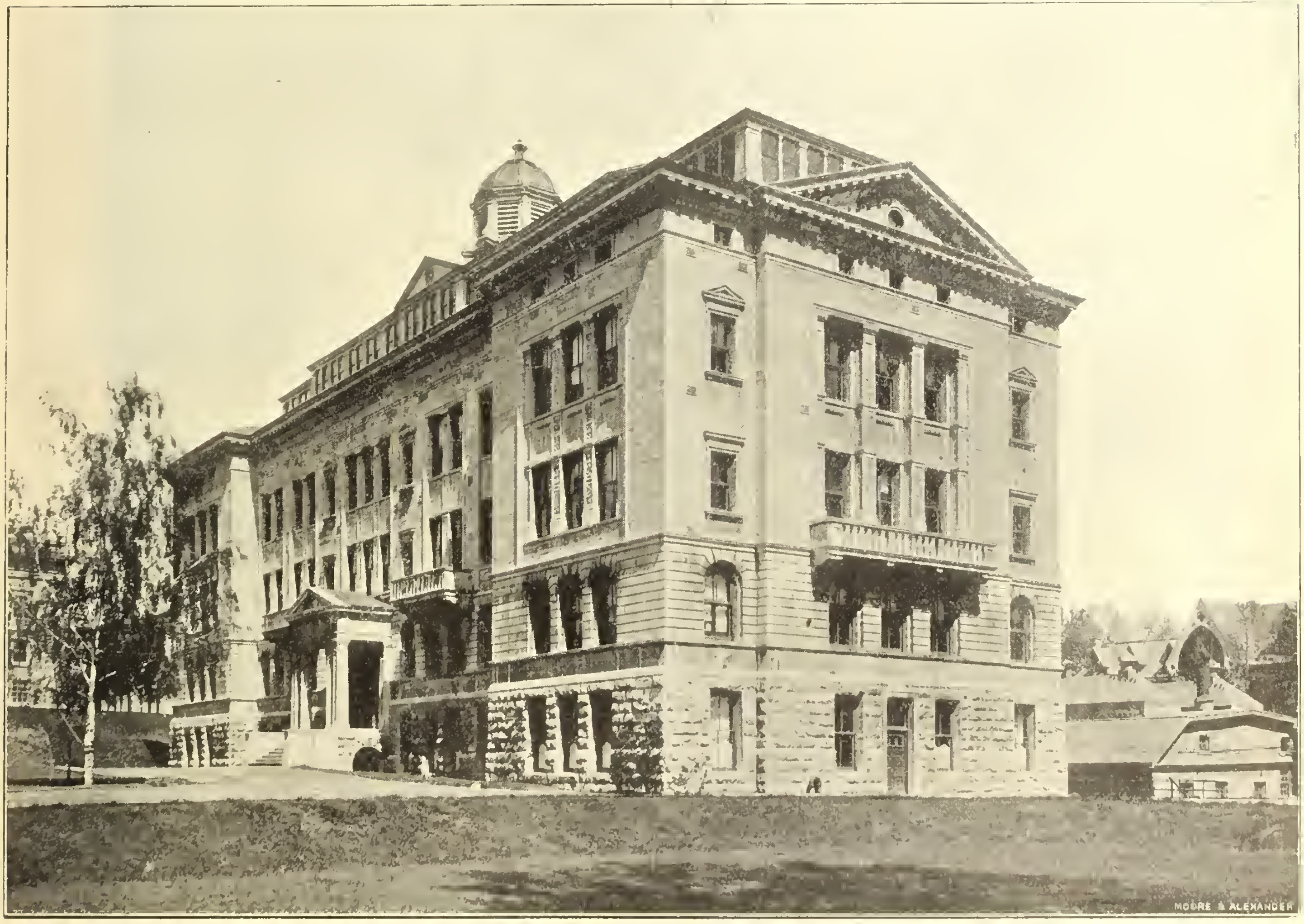

FIG. 1—McDONALD ENGINEERING BUILDING, McGILL UNIVERSITY, MONTREAL.

The power station, the heart of the institution, is well shown in the illustration on this page. In this room all the electric power is generated which is used in the building for lighting and power and for the laboratories and test rooms. It differs in one important particular from a power house for purely commercial purposes, inasmuch as there has been no attempt at standardization in the units adopted as regards the type, the reason obviously being that it has been considered advisable to bring under the notice of the student as many different types of apparatus as possible. Consequently, side by side will be found a Robb-Armstrong engine driving a 75 k.w. direct current 110 volt Crocker Wheeler generator, while opposite is seen a similar size Ideal engine, by Goldie & McCulloch, driving a 75 k.w. Canadian General Electric Company's machine of the same voltage.

Great Britain is represented by two Willans engines driving a Siemens and a Mather & Platt direct current 30 k.w. 110 volt machine respectively. All or any of these machines may be used for either lighting and power for the general uses of the building, or for the laboratory testing purposes, through a four panel switch-board.

In addition to the above, a storage battery has been installed for the purpose of lighting the building when the plant is not running, and for charging purposes a Sprague motor generator is used to raise the voltage about forty volts over the 110 volts of the dynamo plant. The absence of wires is noticeable, all wires and cables being carried in ducts under the tessellated floor, but as these ducts are covered by iron plates they are as readily accessible as if exposed in the unsightly manner so often adopted. In short, the well lighted, airy, clean power house with all necessary appliances, but without any gingerbread fittings for show, is a model of what such a plant in an educational institution should be.

Probably the most important part of the laboratory which is intended for the education of practical engineers, is what is called the commercial laboratory, and it is well named, for not only are all classes and types of machines here gathered together, but are noticeably arranged for commercial work in the most practical way. The test room of a manufacturing establishment, and the usual college laboratory, are generally very dissimilar; the one bearing evidences of the hasty and unscientific methods which are apt to prevail in a commrecial establishment, while the other very often partakes of the nature of a scientific kindergarten. In this case, the arrangements for good practical engineering work are unsurpassed, not only by reason of the great amount of apparatus, but notably by reason of the thoroughly practical way in which the work can be carried on. For instance, each test can be operated independently of any other without that confusion which would inevitably result from an improper and unpractical lay-out of the apparatus, while flexibility of the apparatus is increased to the maximum by the ease by which the machines may be moved from place to place by the travelling cranes and the facility of connection to the circuits, which run in easily accessible channels under the raised floor upon which the machines are set. This floor being equipped with slots and plugs like an iron planer table, is suitable for the base of any machine, and also ensures that the belts may be kept tight without unsightly and cumbersome tightening apparatus. Movable tables of solid construction are provided upon which can be mounted the necessary local instruments and switches which may be found necessary for any particular test which may be undertaken.

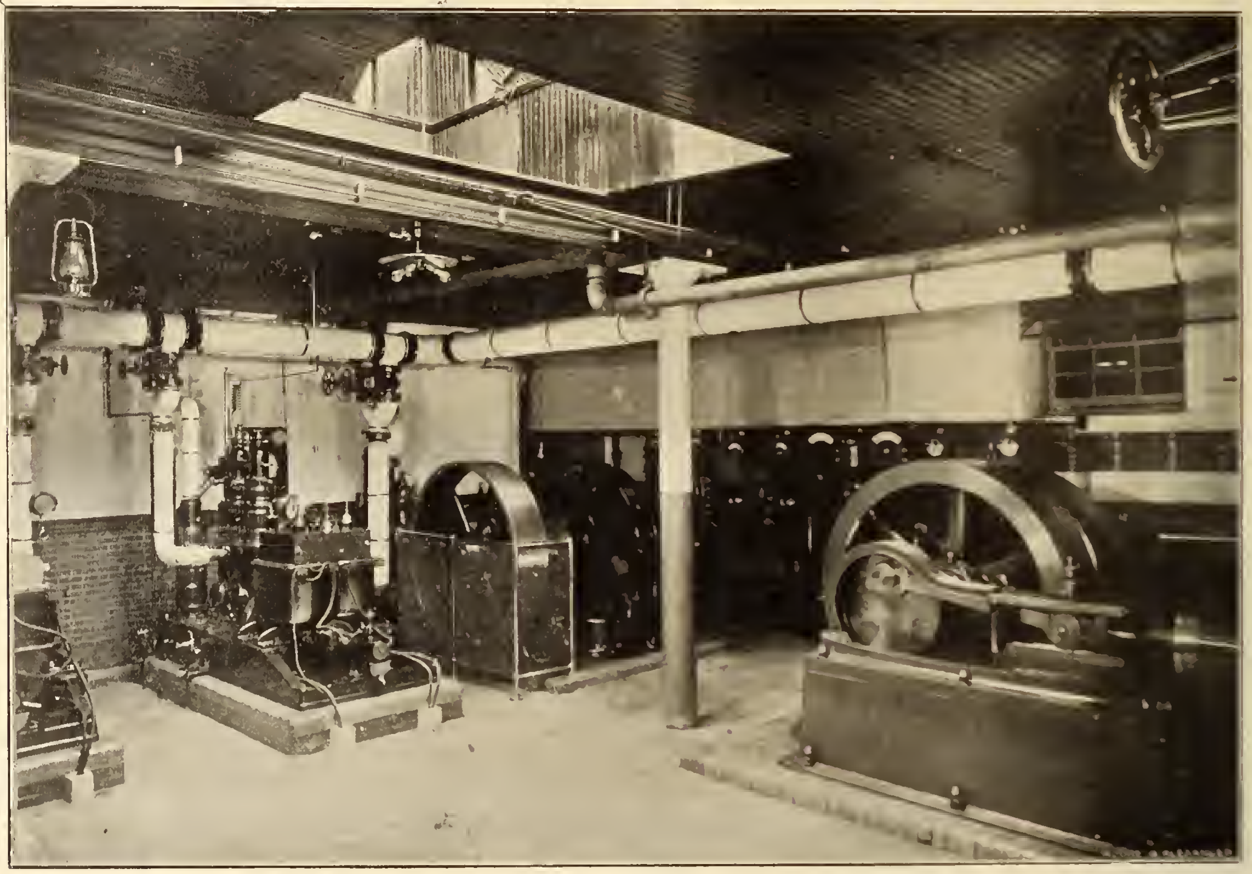

Fig. 2.—Generator Room, McDonald Engineering Building, McGill University

As will be seen by the illustrations (Figs. 3 and 4) this laboratory is divided into sections called the alternating current room and the direct current room. While really the same room, these names are adopted to indicate the classification of the apparatus, for on the one side the alternating current dynamos driven by direct current motors are placed, while on the other the direct current generators and arc machines are set, and as each of these sections has its own travelling crane, cables switches, etc., the two divisions of the laboratory are independent. The alternating current laboratory containing, as it does, examples of the best types of single two and three phase machines, as well as special apparatus for phase and periodicity changing, is probably the more interesting of the two, while the direct current laboratory contains types which are familiar by long association to any one acquainted with the average lighting and power station for commercial purposes. It may be noted that while the size of the machines is not such as to command attention, the largest unit not exceeding 40 k.w., none of them are toys, but of a size sufficient to demonstrate the peculiar features of each type, and are arranged and connected so that the distinctive features of each may be best shown. A glance at the principal pieces of apparatus will illustrate this fact, for we find driven by appropriate variable speed direct current motors the following types :

A 15 k.w. alternator, with revolving fields, made

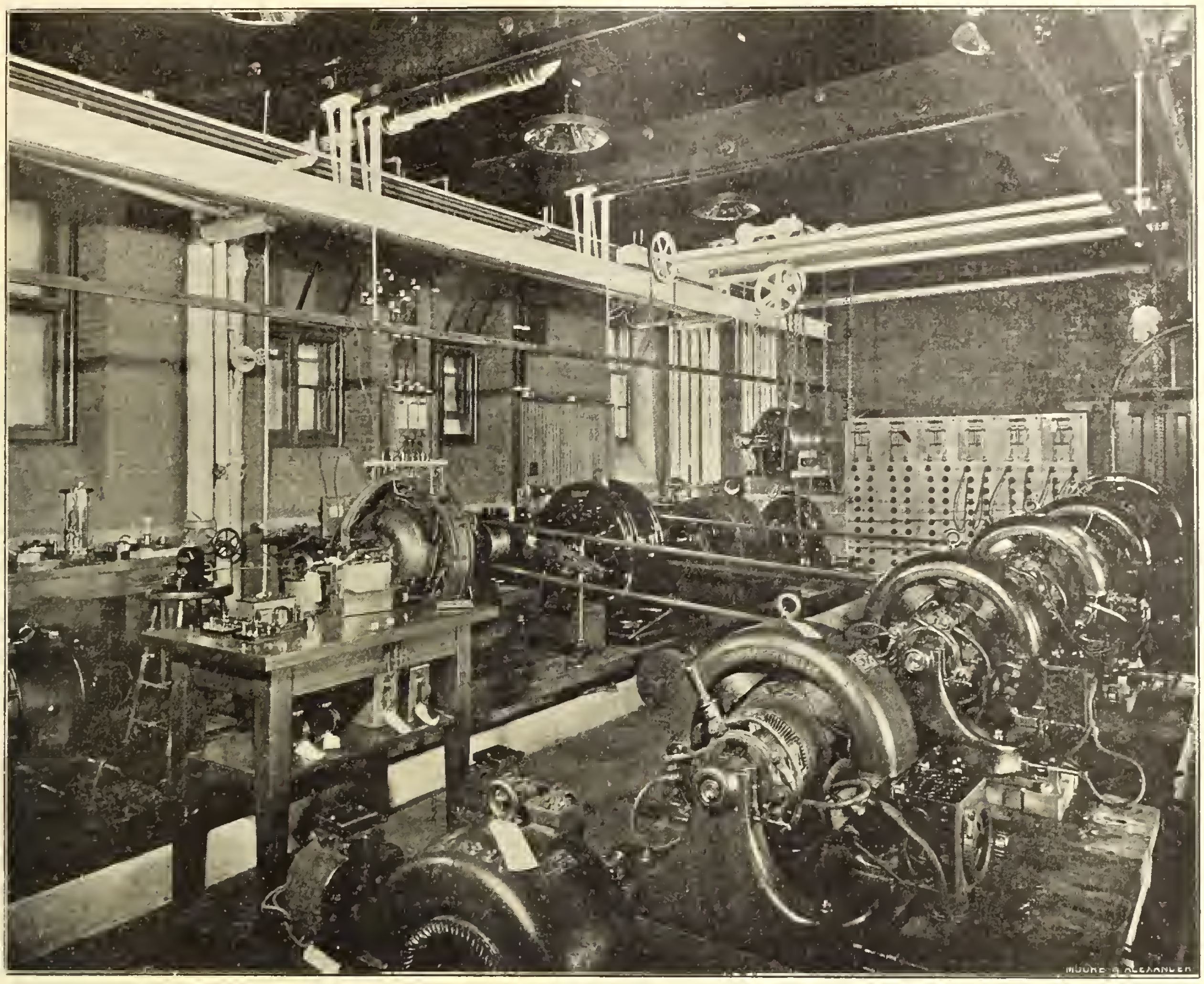

Fig. 3.—Alternating Current Dynamo Room, McDonald Engineering Building, McGill University.

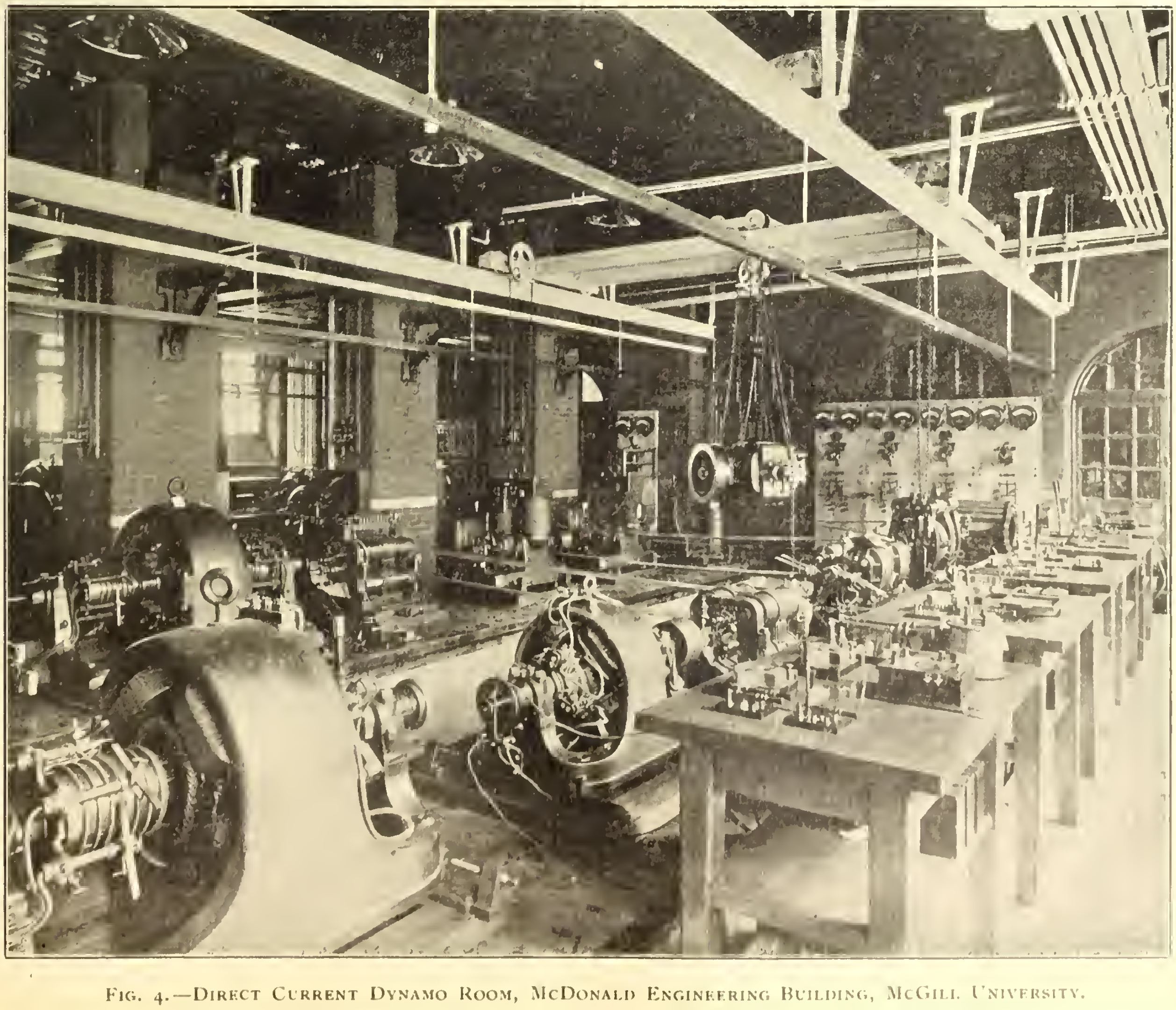

Fig. 4.—Direct Current Dynamo Room, McDonald Engineering Building, McGill University.

by the Canadian General Electric Company which may be used for either single two or three phase operation; a 15 k. w. Stanley two phase alternator, made by the Royal Electric Company, which illustrates the inductor type with stationary armature; a 15 k. w. Warren inductor alternator, for single phase operation; a 12 k.w. Hordey inductor alternator made by the Brush Company; a 20 k. w. one, two or three phase double ended Westinghouse rotary converter, and two others of the same type of 10 k. w. each; a 10 h. p. two or three phase induction motor made by the Canadian General Electric Company, arranged for frequency changer through the variable speed of the driving motor.

In addition there are a number of alternating current motors from two to five h. p., as well as the direct current motors used for the generator drives, which vary from ten to forty h. p., of General Electric and Crocker Wheeler type. The instruments and accessories which must of necessity be used in the work are of every variety and of representative types, and include a number of special instruments of precision not usually found in the laboratory. With the above equipment it becomes easy to meet any case which may arise, and power of any periodicity, phase or voltage is readily obtainable. It is here that the student gets his most practical experience in dealing with alternating currents.

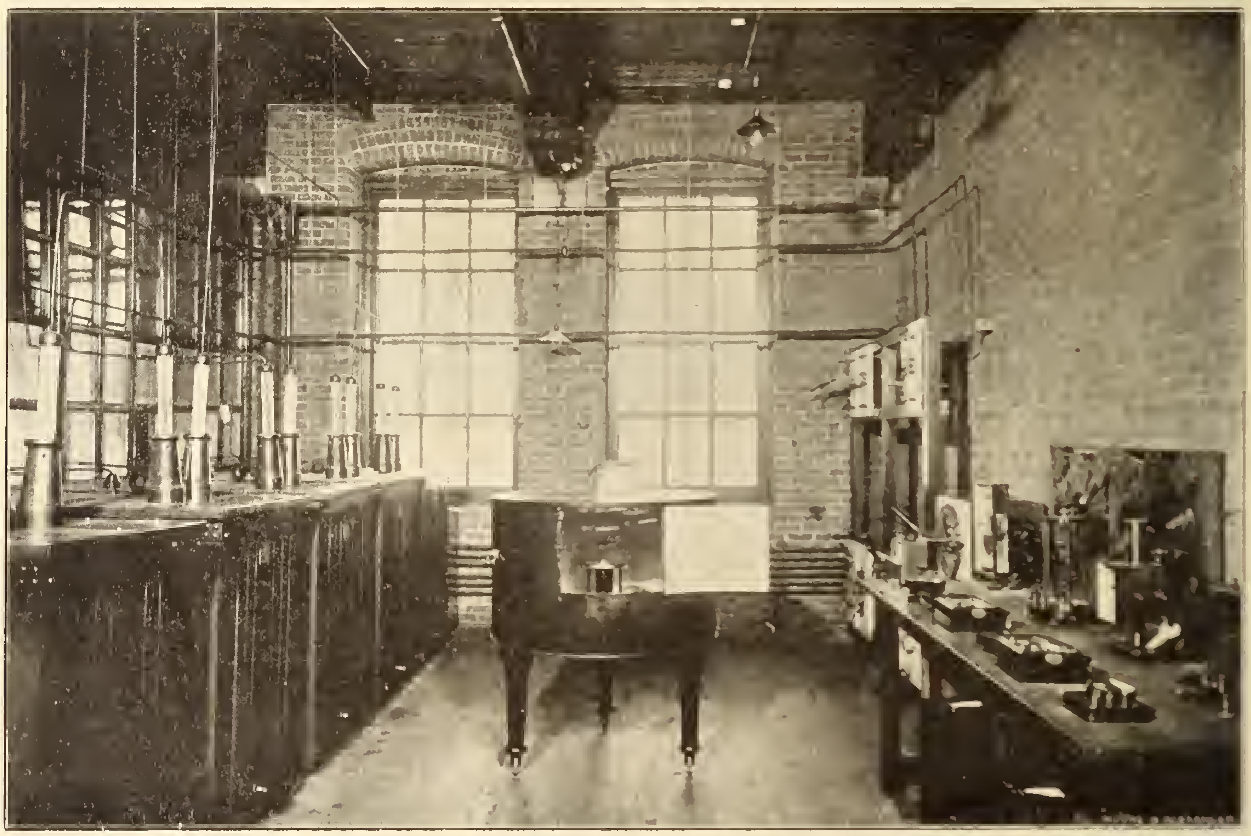

FIG. 5.—HIGH TENSION LABORATORY, MCDONALD ENGINEERING BUILDING, MCGILL UNIVERSITY

The direct current laboratory, while representative of the older and more similar types of machines, will not demand from the student that study which he will have to devote to the alternating section, but as representing direct current machinery and practice it is very suitably fitted up. A glance at the types shows a 16 light Thompson Houston arc machine, a similar size Wood arc, and a ten light Brush arc machine. Of direct current motors there are many of all types and sizes from one-twentieth to 15 h. p., the latter size being a railway motor. These, with their numerous accessories, such as rheostats, switches, arc lamps, starting boxes, etc., allow of a scope for experiment in direct current field which will abundantly satisfy the most enthusiastic student, especially when it is noted that the power station and all the laboratory motors are also of the direct current types.

In addition, there is being installed at the present time a Chloride storage battery of 75 k.w. hour capacity, which is arranged to float on the circuit supplying the laboratory, which absorbs current when the load is light and gives it out when the laboratory demands are great. This battery will thus not only aid the regulation, which is so important where experiments are to be successfully carried out, but will be available for standardizing instruments and similar work where a very steady voltage is required.

The ampere meters, volt meters, condensers, transformers, voltage regulators, electric speed indicators, dynamo meters, etc., are of too great a variety to enumerate, and the resources of European and American makers have been drawn upon in the largest way to make the auxiliary apparatus complete.

With this commercial laboratory so thoroughly equipped, Professor Owens has at his disposal an instrument thoroughly suitable not only for instructive purposes but also for the commercial testing of lamps, transformers, meters, etc.

The high tension laboratory, with its transformers wound as high as 30,000 volts, its electrostatic instruments for measuring pressures of 150,000 volts, with accessories in the shape of meters, regulators, impedence coils, etc., is evidently no place for the freshman of an investigating turn of mind. It is here that all high voltage experiments are carried out, line insulators tested, and completed apparatus subjected to the searching thrusts of thirty thousand volts or so. To the high potential laboratory is due the advances in insulation which have made it possible to transmit power to long distances at high voltages, and it is this department which will be called upon in the future to extend the range of commercial voltages, so that this will be a more important department in the future than seven at the present time.

The standardizing laboratory, where all instruments are calibrated and the most of the high class experimental work is done, is well shown in Figure 6. Here very accurate measurements of voltage, current capacity, self induction magnetization, etc., are made, and it is here that the student receives his training in the use of instruments which should enable him to carry on the work of original research. In this department are to be found standard Kelvin balances for the measurement of current up to 600 amperes, either direct or alternating, electrostatic and multicellular voltmeters up to 10,000 volts, designed by the same eminent scientist; Thomson and D'Arsonvalgalvanometers, standard cells, wheatstone bridges and potentiometers, standard resistances, and a multitude of standard voltmeters and ampere meters. For the testing of irons there are permeability bridges and hysteresis meters designed by Ewing, and special transformers, phase shifters, rheostats and condensers in formidable array complete the more important apparatus. This is the final court of appeal before which all hysteretic and impermeable irons receive their sentences ; here are dragged all untruthful and perjured ampere and volt meters to have their characteristics examined and their faults corrected.

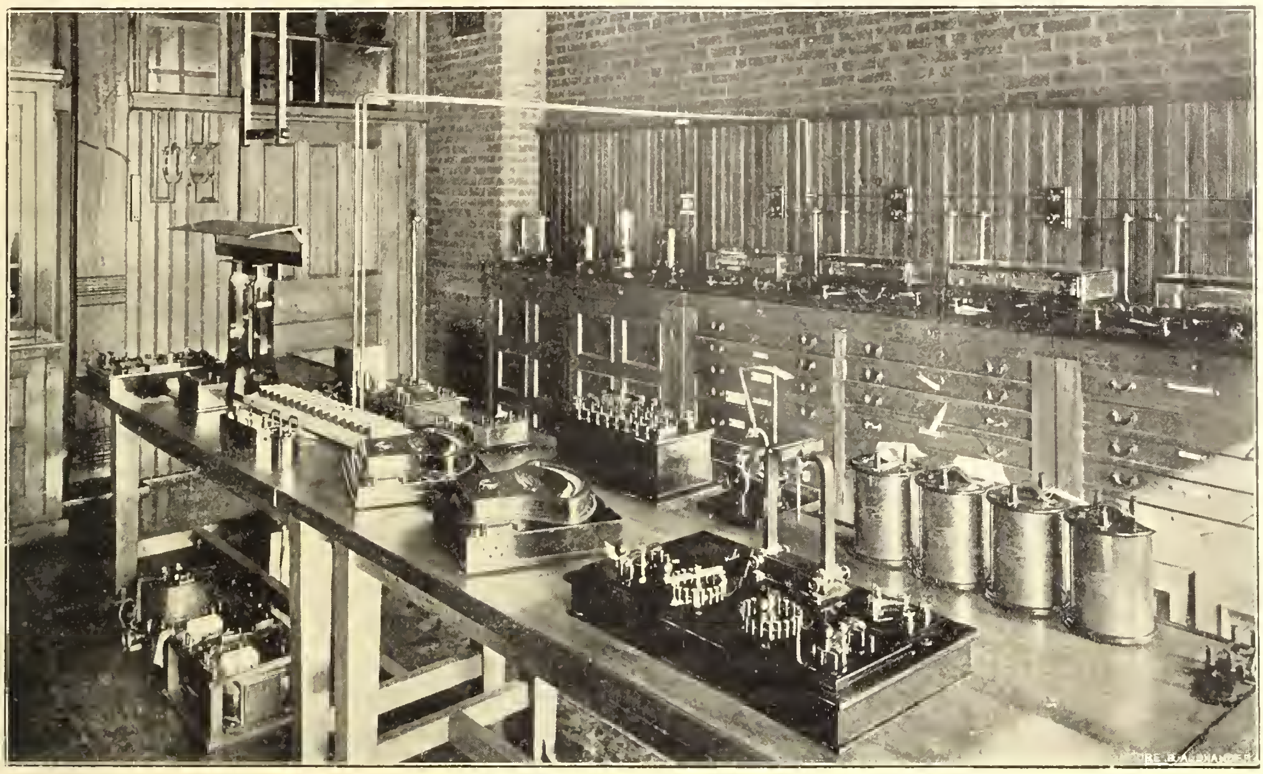

Fig. 6.—Standardizing Laboratory, McDonald Engineering Building, McGill University.

From the standardizing laboratory the student reaches the original research laboratory, where in his later years he is given a free hand to investigate for himself certain promising fields for which his previous training has fitted him. Several special instruments are here placed, but the greater portion of those here used may be drawn from the other departments as required. In addition we should mention the shops where skilled mechanics repair and construct special apparatus for the use of the laboratories.

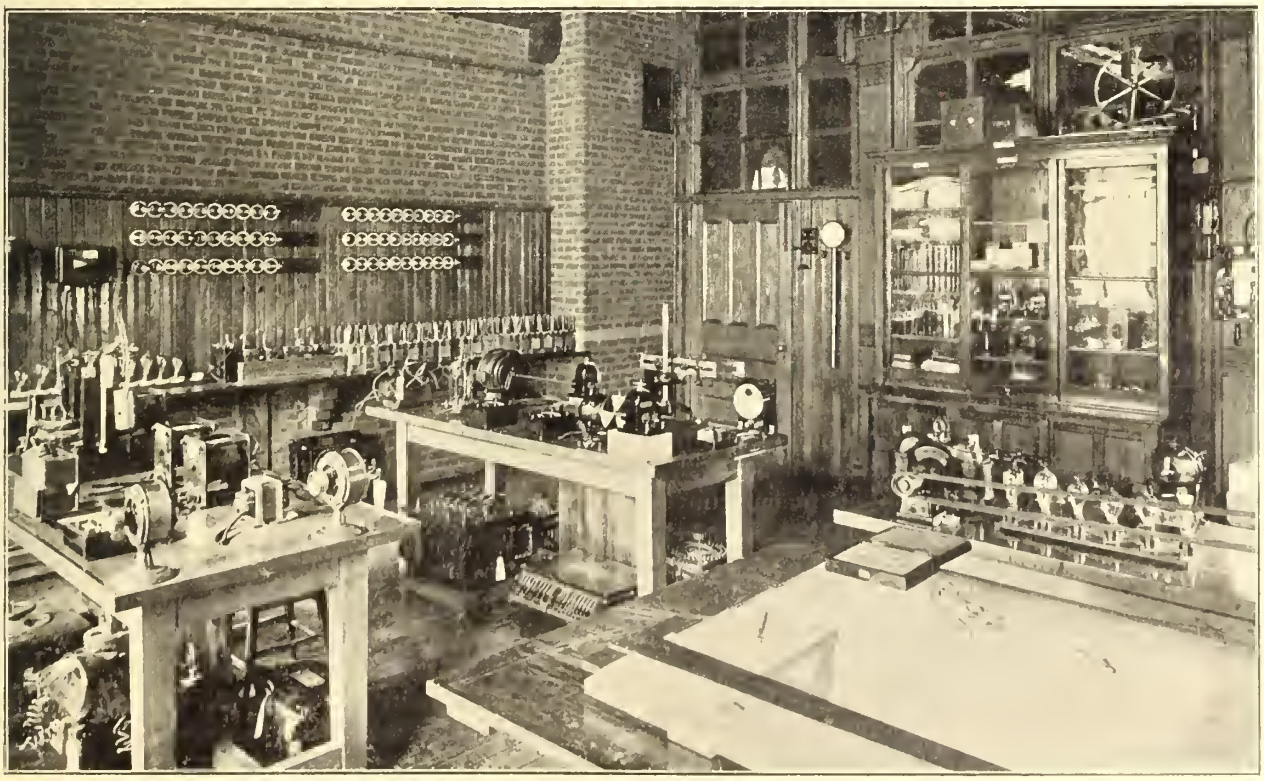

Fig. 7.—Special Investigation Room, McDonald Engineering Building, McGill University.

CANADIAN
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The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. When ordering change, always give the old as well as the new address.

The Publishers should be notified of the failure of subscribers to receive their paper promptly and regularly.

The Growth of Electrical Engineering. REFERENCE was made in our last issue to the large number of fourth year engineering students at McGill University who are taking the electrical engineering course, the proportion of such students being sixty per cent. of the fourth year men. We learn on subsequent enquiry that at the School of Practical Science, Toronto, a still larger proportion, namely, 62½ per cent. of the senior students, are taking the course in electrical engineering.

A Misrepresentation. The ELECTRICAL NEWS has been advised that a representative of a certain trade journal who is now travelling in Great Britain has represented to British manufacturers of electrical supplies that there is an enormous field for their goods in Canada. As a consequence, advertisements have been placed in the said journal, and the representative in return has furnished to the British manufacturer the names of Canadian supply houses, to whom letters have been sent offering electrical goods. It is to be regretted that the actual situation should be misrepresented. It is well known that the demand for British electrical goods is exceedingly light in this country. Take, for instance, incandescent lamps; the bulk of those used in Great Britain are manufactured outside of the country, while the T.H. base so much used here is practically unknown there. So with sockets. Owing to their using more keyless than key sockets, the shades are generally not arranged for a holder, but with a hole in the centre, the same as for the Edison old style systems here. The difference between wire gauges here and in Great Britain is likely to result in errors occurring in orders, as the buyer here is more accustomed to the B. & S. than to the B.W.G. Considering the population, there is indeed a large consumption of electrical goods in Canada, but before British firms can secure a reasonable share of the trade it will be necessary to introduce a number of important changes in manufacturing methods. If their goods are manufactured to meet the requirements of the Canadian trade, there is no reason why British manufacturers should not increase their exports of electrical goods to this country, as witness the large quantity of these goods now imported from the United States and Germany. But the persons to properly develop the trade are those versed in electrical matters, while the prospects of business are lessened by the tactics of the journal above referred to.

A 150-Mile Transmission. WITH the immense water power of the Niagara Falls situated about eighty miles from the city of Toronto, the undertaking of the Standard Electric Company, of California, has a peculiar interest for Toronto citizens, and especially at the present time when the necessity of cheaper power for our manufacturing industries is so fully recognized. In the project of the Standard Electric Company we have an object lesson which may encourage the development of Niagara power. It should be stated, however, that in California the cost of coal is much greater than in Ontario, giving a water-power plant there an advantage over steam which would not apply in the case of transmitting power from Niagara Falls to Toronto. The power house of this company is located at Blue Lakes, and for some time electric power generated at this point has been transmitted to Stockton, forty-six miles distant. The ultimate intention is to transmit the power to San Francisco, a distance of one hundred and forty-five miles, for which purpose a plant is now nearing completion. In addition to being the longest transmission line ever operated commercially, the plant will be distinctive for two other reasons, first, that the current will be transmitted at a pressure of 60,000 volts, which is twice as high as has heretofore been attempted, and, secondly, that aluminum wire will be employed as the conductor. The high voltage employed will necessarily reduce the cost of the transmission line. This is one of the advantages claimed for aluminum as a conductor. The relative merits of copper and aluminum for the transmission of electricity have been much discussed of late, and it cannot fairly be said that the experiments thus far with aluminum have shown it to possess an efficiency equal to that of copper, while its resistance to atmospheric influences is not as great as was at first supposed. The companies in America who have employed aluminum wire are the Snoqualmie Falls Power Company, a 34 miles transmission, with 29,000 volts; North Yuba Power Company, of Sacramento, 63 miles; Hartford Electric Light Company, 11 miles, 10,000 volts; Cottonwood Power Company, of Utah, 12,000 volts; Telluride Power Company, of Provo, Utah, 80 miles; Niagara Falls Power Company, for a short transmission; and the Standard Electric Company above referred to. In connection with the transmission of power from Ragged Rapids to Orillia, Ont., it was originally proposed to use aluminum wire, but for some reason this decision was not adhered to. It would seem that the use of aluminum is yet quite experimental, and that its use may develop obstacles difficult to overcome.

Prevention of Smoke. IN cities where manufacturing is carried on to any extent a question of some moment is the prevention of annoyance from smoke emanating from steam boilers. For three years past a law has been in force in the city of Montreal providing that all steam users must equip their plants with apparatus for consuming the smoke, while a by-law has received its second reading in the Toronto city council designed to accomplish the same purpose. To the latter by-law exception has been taken by the Canadian Manufacturers Association, and rightly so, as in its present crude form we believe the ordinance to be unworkable. It provides that all manufacturers using combustible material to produce heat or power shall apply such apparatus as shall prevent the smoke from fouling the atmosphere, and in the event of neglecting, they are to be subjected to a fine of fifty dollars for each offence. The objections urged against the by-law are that the method of conviction is such as would place manufacturers entirely at the mercy of unscrupulous persons who might from time to time feel disposed to persecute them, and that the by-law should be more explicit and state what device will satisfy the requirements and exempt a manufacturer creating smoke from liability to prosecution. The difficulty of overcoming the smoke nuisance is well illustrated by the experience of cities in the United States. Although in a number of cities such by-laws as the one under consideration are in force, the results in the main seems to have been unsatisfactory. In Rochester, for instance, such a law was enacted twelve years ago, but was subsequently repealed. In Syracuse it is not considered a success, while in Pittsburg, Cleveland and Chicago it is said to have relieved the trouble only in a slight degree. In these cities the duty of enforcing the law devolves upon the city engineer or some other competent person appointed for the purpose. The strongest objection that can be advanced against the enactment of a law such as that framed by the Toronto city council, is the doubtful merits of smoke consumers. The opinion seems to prevail, based upon experience, that of the various smoke consuming devices on the market none will accomplish the purpose for which they are intended, and it is a question in the minds of manufacturers whether the degree of efficiency to which they have attained will warrant the expenditure necessary for their installation. Tests of smoke consuming devices have been made in Toronto with the result of increasing the cost of operating the boilers, without abating the nuisance. To our mind, the prevention of smoke from steam boilers has more nearly reached attainment than the consumption of smoke. The methods of firing boilers have undergone great changes in recent years. With these changes have come better combustion and a decreased quantity of smoke. The automatic stokers have, we believe, accomplished much towards smoke prevention. We are told that by this method of firing, the O'Keefe Brewing Company, of Toronto, have practically overcome all annoyance from smoke, and at the same time have effected a saving of fifteen per cent. in fuel. The trouble may also be diminished by the erection of higher chimneys, by having sufficient boiler capacity so that it becomes unnecessary to force the boilers, and by the edncation of the boiler attendants. By means of a high chimney a better draft through the furnace is secured. This will assist in relieving the smoke and also effect a saving in fuel. The matter of educating the firemen is one which has received attention in Great Britain, where in some cities the law is such that where the boiler capacity is ample and smoke is allowed to emanate, the fireman instead of the owner is prosecuted for the offence. The Canadian Manufacturers Association have suggested that the city council make a test at the waterworks plant of the various smoke consuming devices, and decide upon one which will meet the letter of the law. This, we think, is placing the responsibility upon the proper shoulders, but we are by no means sanguine that the results accmplished will be satisfactory either to the city council or to steam users, as it seems impossible to select a device that will meet the varying conditions under which different steam plants are operated.

THE CATARACT POWER COMPANY.

The Cataract Power Company, of Hamilton have been making extensive alterations and additions to their power house, distributing lines and transformer station. Having found it necessary to increase their plant, they have just installed two new 3,000 h p. turbines, manufactured in Milan, Italy, two 2,000 k.w. S.K.C. generators, ten 400 k.w. step-up transformers, three 300 k.w. rotary converters, and a chloride storage battery equipment. They have also built a second transmission line of No. 00 copper wire. A new building is nearing completion which will contain the rotary transformers, arc light apparatus, new battery equipment, and the switch-boards. It is the intention of the company to close down the power houses of the Hamilton Electric Light Company, the Hamilion Street Railway Company, and the Hamilton Radial Railway Company, and to distribute altogether from the step-down station on Victoria avenue, the incandescent, arc, power and railway service being supplied from one building.

The generators recently installed are among the largest yet built in Canada, and, we understand, by weight, the largest in North America. Each generator has a capacity of 2,000 k.w., with a large overload capacity. The weight of the generator complete is over 110 tons, or 220,000 pounds, and is similar in design to the 1,000 k.w. machine two of which the Cataract Power Company now have in their station. The total capacity in generators is over 10,000 h.p. The entire machinery throughout has been supplied by the Royal Electric Company, Montreal, and consists entirely of S. K. C. apparatus operating at two and three phase. This is now one of the most complete power stations in Canada, and is giving excellent results.

THE CHAMBLY POWER PLANT.

An unfortunate accident occurred at Chambly early in November, when a portion of the Chambly Manufacturing Company's dam adjoining the power house was swept away. The main part of the dam remained intact, but about 150 feet situated close to the shore and used as sluice gates for waste water was destroyed.

The accident is said to have been due to the water loosening the concrete embedded around the gates. The loosening of the concrete had been noticed, and means were about to be taken to strengthen it.

The lighting service was not interrupted to any extent as the result of the accident, as the steam reserve plant retained by the Royal Electric Company was immediately called into requisition.

In connection with the additional plant about to be installed at Chambly, some important changes will be made. The line voltage will be changed from 12,000 to 25,000 volts, and the generator voltage from 12,000 to 2,000 volts. The line will be changed from four wire to three wire transmission. The four new generators to be installed, and which were referred to in last issue, will be 2,000 k.w., 2,000 volt machines, of the revolving field type, while the new turbines will consist of sixteen 51 inch S. Morgan Smith wheels, with possibly Lombard governors. It is also the intention to put in ten 2,000 k.w., 2,000 to 25,000 volt air blast transformers, and to deepen and widen the trail race.

A BRIEF HISTORY OF THE SCHOOL OF PRACTICAL SCIENCE.

THE banquet to be tendered on December 21st to Professor Galbraith, principal of the School of Practical Science, Toronto, by the faculty, graduates and other graduates, has naturally carried the thoughts of many back to the early days of the school, as almost since its inception the name of Professor Galbraith has been regarded as synonymous with the success of the school. Established in a modest way to meet the demands for technical and scientific education, the growth of the institution has been almost phenomenal, until the increased accommodation provided from time to time is now entirely inadequate.

The present School of Practical Science is the successor of the College of Technology, an institution which was practically an evening technical school for artisans and others, and which occupied the building of the present public library, corner Church and Adelaide streets. The origin of the present school dates from January 30, 1877, when the Legislative Assembly, in accordance with the recommendations of a report to the Hon. Adam Crooks, Minister of Education, by Professor James Loudon, sanctioned the proposal for the permanent establishment of a School of Science, and authorized the erection of a new building upon a site in proximity to the University of Toronto. The character of the institution was greatly changed, and under the new arrangement the chief object of the school became the teaching of engineering and applied chemistry. It was decided, by an arrangement with the Council of University College, to utilize the teaching power of that college which already existed for the like objects in four departments and could be made applicable to the wants of the School of Science, and in addition thereto to appoint a professor of engineering and such assistants as might be found necessary. This arrangement continued until the end of 1899, when the departments of science were transferred from University College to the University of Toronto, under the operation of the University Federation Act. That the students might continue to receive instruction in the above departments in the same manner, the School of Science was affiliated to the University of Toronto.

PROF. GALBRAITH,
Principal School of Practical Science, Toronto.

The building erected at that time forms the north wing of the present school. Besides being the home for the engineering classes, it furnished accommodation for the departments of biology, chemistry, and mineralogy of the University, the engineering department having but one floor.

The first calendar of the School of Practical Science is denoted as the session of 1878-79, and the faculty consisted of H. H. Croft, D.C.L., professor of chemistry; E. J. Chapman, Ph.D., L.L.D., professor of mineralogy and geology; James Loudon, M.A., professor of mathematics and natural philosophy; R. Ramsay Wright, M.A., B.Sc., professor of biology; J. Galbraith, M.A., Assoc.Inst.C.E., professor of engineering; W. H. Ellis, M.A., M.B., assistant professor of chemistry. The attendance at the school in this year was six students.

From the calendar we notice that there was three courses, namely: (1) engineering; (2) assaying and mining geology; (3) analytical and applied chemistry. Regarding the engineering course, it is stated that in the absence of a machine shop visits to workshops and excursions during the long vacation will be taken advantage of.

An important event in the history of the school occurred on November 6th, 1889, when Professor Galbraith was appointed principal and the management of the school entrusted to a council composed of the principal as chairman and the professors, lecturers, and demonstrators appointed on the teaching faculty of the school. Recognizing the necessity of embracing every branch of applied science, the principal decided to extend the curriculum of the school so as to embrace five regular departments of instruction, in each of which diplomas would be granted, namely, (1) civil engineering (including mining engineering); (2) mechanical engineering (including electrical engineering); (3) architecture; (4) analytical and applied chemistry; (5) assaying and mining geology.

In 1889-90 the management of the school was entrusted to a council of five, consisting of Professors Galbraith and Ellis, and Messrs. C. H. C. Wright, B.A.Sc., lecturer in architecture; T. R. Rosebrough, M.A., demonstrator in engineering; and L. D. Stewart, O.L.S.,D.T.S., lecturer in surveying, with Professor Galbraith as principal. These five are still members of the council, which has been enlarged to include A. P. Coleman, M.A., P.L.D., professor of assaying and metallurgy; J. A. Duff, B.A., lecturer in applied mechanics; G. R. Mickle, B.A., lecturing in mining; R. W. Angus, B.A. Sc., lecturer in mechanical engineering; A. T. Laing, B.A.Sc., demonstrator in surveying; and J. W. Bain, B.A. Sc., demonstrstor in analytical chemistry. In addition six Fellows have been appointed from among the late graduates.

As early as 1888 the necessity of providing increased accommodation was recognized by the Government, and an appropriation made for the erection of a large addition to the building. This addition was completed in 1891, the equipment and the laboratory plant installed being of the best then procurable. The building as now occupied represents a floor space of nearly 60,000 square feet, but, notwithstanding, the accommodation is overtaxed, and the work of the teachers made laborious by the necessity of repeating lectures and laboratory experiments three or four times in order that all the students may receive the instruction. It has also been found necessary, from the same cause, to abandon certain experimental and research work.

That the School of Practical Science is meeting the demands of the people is clearly demonstrated by the almost constant growth in attendance. The present year is the largest yet on record, the attendance being about 220. Of these 105 are taking the mechanical and electrical course, 57 the civil engineering course, and 55 the mining course. In each of these depatrments the faculty and equipment of the school are such as to guarantee the student a thorough training in the scientific principles underlying the practice in the different professions. The splendid equipment in the electrical laboratory has already been described in these columns, while the facilities for the study of mining are equally efficient. The mining course as distinct from that of civil engineering was first established in the session of 1892-93.

It is interesting to learn that the graduates of the School of Practical Science are finding employment in connection with the development of the natural resources of the country, and that many of them are now occupying responsible positions. A glance at the calendar shows that of the 263 living graduates of the school, about 75 per cent. are employed in Canada, while the remaining 25 per cent. are scattered over other parts of the world.

PROFESSOR GALBRAITH.

The head of this admirable institution, Professor John Galbraith, is a son of the late Thomas Galbraith, of Port Hope, well known to every Scotchman in Canada as the Canadian agent of the "Scottish American." He was born in Montreal on September 5th, 1846, and educated at the Port Hope Grammar School and Toronto University. At the latter he took several scholarships in mathematics and general proficiency, and graduated in 1868 with the degree of B.A., securing the gold medal in mathematics and the Prince of Wales' prize for general proficiency. In 1875 he was granted the degree of M.A. He studied engineering and surveying under Mr. George A. Stewart, chief engineer of the Midland Railway, and was admitted as a Provincial Land Surveyor. He was employed for some ten years in railway construction work on the Intercolonial Railway, the Midland Railway, location of the Georgian Bay branch road, and exploratory surveys for the C.P.R. He was also employed for some time in the Portland Co.'s locomotive shops at Portland, Maine, U. S., and did consulting work in hydraulic engineering, receiving the appointment to the chair of engineering in the School of Science in the fall of 1878.

Professor Galbraith was one of the founders of the Canadian Society of Civil Engineers, serving for five years on the council of that body. He is also an associate member of the institute of Civil Engineers of London, England.

As principal of the School of Science, Professor Galbraith has labored zealously in its interests, and to him is due much of the credit for the high degree of efficiency which has been attained. At the outset he had an object in view. This was to fit the student for active professional work by giving him a thorough training in scientific principles rather than by attempting to give him a so-called practical training. It is along this line that the efforts of the school have been concentrated, and the wisdom of such a policy seems to be borne out by the results. If one were to enquire from any of his co-workers as to the secret of Professor Galbraith's success, the reply would probably be that it was due to his great qualifications in the direction of organizing the work at the school. As remarked by an intimate acquaintance, "he is a wonderful organizer."

After having completed his 21st year as head of the school, the proposed banquet to be tendered him is a fitting tribute of respect.

QUESTIONS AND ANSWERS

A subscriber enquires as to what amount of power can be generated by the Westinghouse generators recently installed on the Canadian side of Niagara Falls.

"Mill Owner" writes : Where water power is not obtainable, and where coal can be bought for $1.80 a ton, could electricity be generated and electrically applied by motors to the extent of 500 h.p. as cheaply as by belting and shafts, where said power would be used within a radius of 100 feet of engine shaft.

Ans.—Broadly speaking, the original or capital outlay to cover the cost of the dynamos to convert the mechanical power of the engines into electrical power, the necessary wire to carry that power to the various motors, and the motors to convert it back to its original mechanical shape, will cost considerably more than the belting and shafting necessary for the same work, though in the absence of the detail of the proposed layout, it is impossible to give even approximate figures. The relative cost of operating the two systems will also depend entirely on the details of the particular installation in question, though it is likely to be somewhat in favor of the electric plant, the more so as the average load drops below the full load or rated output of the whole installation. The relative advantage of the two systems, outside of the question of cost, are in every way in favor of the electric, it having the superiority in (1) simplicity and freedom from noise and dirt in the transmitting device (the wires), (2) its great flexibility, (3) facility for future extensions, with but very little change and modifications in the already existing plant, (4) the ability to furnish light as well as power, with a maximum of convenience at a minimum of cost.

"Reader" asks : Why is that a person when receiving an electric shock is unable sometimes to let go of the object grasped.

Ans.—The muscles of the hands are divided into two sets, called extensor and contractile, the former being used to open the hand when the fingers are called on to release their hold, the latter having control over the grasping or clutching powers of the hand and fingers. Obviously, as the latter action requires the exercise of very much more power than the former, the muscles controlling it are proportionately stronger than those of the latter. Now, the action of a current on the muscular system is to excite it to a state of great activity and to deprive it of its ordinary controlling power, the mind; consequently, when the muscles are agitated and left, as it were, to their own devices, the stronger set overcomes the weaker, the result being that the hands remain clenched.

"J. H.," Rossland, B.C., writes : I was told by an agent who was here the other day, that the live wire for a two-phase 3-wire system would cost me less than for a three-phase system; is he right ?

Ans.—We presume that the length of line, the voltages and the load are to be the same in each case, which, if so, would make his contention wrong, for the following reason. If you connect a two-phase machine, whose voltage across the terminals of each phase is say 2,000, to three line wires, you will get 2,000 volts between the common or neutral wire and either of the other two, but between these two latter you will get about 2,830 volts. On the other hand, there will be but 2,000 volts across any of the 3 line wires connected to the terminals of a 2,000 volt three-phaser. Such a two-phase system, if run with 2,830 volts across the two outsides, it is quite true, will take about 2 per cent. less copper than the three-phase machine with a minimum voltage of 2,000, but if the voltage of the former be reduced until its maximum line voltage is the same as the other, namely, 2,000 volts, it will require about twice as much copper as the three-phase machine, the length of the line and the load being the same in each case.

"Engineer" says : I want to put in a pump to supply fifty thousand gallons per day to our factory system for use in the various parts of the shop, and propose to pipe the discharge from the pump into a tank 96 feet from the ground, about how much horse-power will it take to drive the pump ?

Ans.—We suppose that you intend to deliver the above 50,000 gallons in an ordinary working day of 10 hours, and also that you refer to the standard Imperial or English gallon, not the U. S., the former weighing 10 lbs. per gallon, the latter about 8 1/3. If we are correct in our supposition, the following is the easiest way to get the horse-power necessary : Since a h.p. is equivalent to 33,000 lbs. raised one foot in one minute, which is usually expressed as 33,000 foot pound minutes, the problem consists in finding how many foot pound minutes there are consumed in doing the work described, which is given by the following : 50,000 gallons per 10 hours = 5,000 gallons per hour = 83 1/3 gallons per minute; 83⅓ gallons at 10 lbs. per gallon weigh 833 1/3 lbs., which raised through 96 feet will represent 80,000 foot pound minutes; this divided by 33,000, which as explained above are the number of foot pound minutes in a horse power, will give the h.p. required, which is slightly over 2 4/10 ; but it must be remembered that this is the delivered output of the pump, which, including mechanical and water frictions, is of above 60 efficiency, so to get the actual horse-power consumption required, 40% should be added to the above figure, giving a final result of 3 39/100 h.p.

Mr. Donald McIntyre, who owns a water power about three miles north of Paisley, Ont., has found it necessary to increase his electric lighting plant. He has ordered from the Royal Electric Company one of their 60 h. p. S.K.C. two-phase alternating current generators, and has added a third wire to his lines from the water power to the town, thus putting him in a position to furnish power as well as light.

THE ELECTRIC STORAGE BATTERY AND ITS COMMERCIAL APPLICATION*.

By C. E. Brown.

The advent of the storage battery accumulator, or secondary battery, as it is variously called, into the field of electrical engineering is of comparative recent date. This is more especially true on this side of the Atlantic than in European countries, where its use had preceeded by several years its general application on this side.

But a few years ago, perhaps five or six, it was necessary to point to European practice for all examples of successful accumulator application on a large scale and along advanced lines. This is no longer the case, as American storage battery practice is as far advanced as in any part of the world, and the American storage battery has no superior. The largest installations, too, are to be found in American cities. Its growth in importance in these few years is little short of phenomenal, and it is still rapidly increasing. The majority of the very large central stations, such as those of the Edison illuminating companies of the larger cities and the large street railway companies, depend very largely upon it, and its adoption is coming to be quite general in medium and smaller sized stations.

The history of the storage battery is practically included in the last 30 years, though the phenomena on which it is based was observed as far back as 1801. In that year Gautherot found that after decomposing water with a volta's cell, if the platinum or silver electrodes were connected together, a secondary current would flow for a brief time. The history of the storage battery from this time until the time of Plante includes the names of Volta, Davy, Schoenbein, Grove, Wheatstone, Siemens, Faraday, and others, but no practical results seem to have followed. In 1860 Gaston Plante constructed the first practical storage cell from two sheets of lead 60 cms. long by 20 cms. broad by 1 mm thick (25″x 8″x1/25″) coiled into cylindrical form, the two plates being separated by felt and the whole immersed in dilute sulphuric acid. Plante continued his researches up to 1879, which practically determined the state of the art. In 1879 Metzger applied the active material mechanically, and in 1881 Faure obtained important patents on mechanical application and shortening of the forming process. The history from this time has been in connection with its applications to practical use.

"The storage battery," according to Houston, "consists of two inert plates of metal or metallic compounds inmersed in an electrolyte which is incapable of acting upon them considerably until a current has been passed from one plate to the other. On the passage of a current through the electrolyte its decomposition is effected and the electro positive or electro negative radicals are deposited on the plates, so that on the cessation of the charging current there remains a voltaic cell capable of generating an electric current."

The commercial storage battery of to-day consists of plates or frames of lead or an alloy of lead, with oxides of lead formed on, or pasted on the surface or in grooves or pockets of the plate, three or more plates being assembled together and immersed in an electrolyte of dilute sulphuric acid. The alternate plates are connected together for one electrode and the intermediate ones for the other. The metallic plate or frame of lead or an alloy of lead form the framework or support of the electrode and serves as a means of conducting the current to and from the active material. The oxides or other compounds on the surface or in the pockets or grooves are the active material, and together with the electrolyte are the seat of chemical actions which result in the formation of compounds which in the charged state are of relatively high energy of formation and in the discharged state relatively low, so that in passing from the former to the latter energy is given out, and passing from the latter to the former energy is absorbed. This amount of energy given out or absorbed is practically equal to to the electrical energy of discharge or charge. The sulphuric acid is the active part of the electrolyte, the water acting principally as a solvent used to give more favorable conditions for the action of the sulphuric acid. The plates are usually separated by perforated sheets of hard rubber or celluloid or glass rods, and all plates bound together with rubber bands. The containing vessel may be of glass or hard rubber or of lead lined wooden boxes. The number of plates varies from three to nearly one hundred in the largest batteries installed, with a corresponding variation in capacity from a fraction of one ampere to 10,000 or 12,000 amperes, the current depending both on the number and size of the plates. The voltage, on the contrary, depends on the number of cells, being approximately two volts per cell for commercial batteries.

The form and construction of plates differ very greatly. The first Plante cells were made up of thin sheets of lead with an insulating material between them. Plante found that these plates to give much capacity must be made porous on their surface. To accomplish this result he changed his cells, first putting in the current in one direction, then discharged them, reversed connections, and again charged with the current in the opposite direction. Thus the plate that was made positive on one charge was made negative on the next succeeding charge, and this process was repeated a large number of times. This he called forming the battery, and it required no less than thirty reversals to bring it up to its full capacity. After his plates were well formed he found that they soon became rotten, owing no doubt to the thinness of the plate, the chemical actions having penetrated completely through. The capacity of these cells per pound of plate was large, and has not been exceeded by the same class of battery to-day.

In 1879 Metzger did away with the tedious and expensive forming process by making boxes of perforated lead, which he filled with a mixture of lead oxide, sulphuric acid and potassium silicate for his active material. One box so formed he used for his positive plate and another for his negative. This cell was formed in two or three days, a great improvement over the very long period by the old Plante process.

Faure, working independently and at about the same time, developed this class of plate in which the substance to become the active material is mechanically applied, and which has since come to be known by his name. He applied lead oxide in the form of a paste to the surface of lead plates such as had been previously used by Plante. The positive and negative plates were separated by felt and dilute sulphuric acid used as an electrolyte.

These two types of plate, the Plante and the Faure, are the prototype of all commercial storage battery plates in use to-day, and practice is about evenly divided between them. In general, European practice inclines toward the use of the Faure type, while American practice favors the Plante. The Faure type gives a comparatively large output per pound of plate, but is best suited for moderate rates of discharge covering a considerable period of time, whereas the Plante gives a smaller output per pound, but is capable of working at very high rates of discharge.

The thin, flat plates used in the early Plante cells have been subjected to numerous modifications devised for getting a greater surface with heavier and more rigid plates, for securing better adhesion of the active material when found, and obtaining greater durability, etc. A few descriptions of typical plates will serve to illustrate the direction of these improvements. No pretense of completeness is made in these lists; that would take a far longer paper than this is designed to be, neither is it claimed that the plates described are necessarily the best of their type. It is thought, however, that they are typical of good storage battery practice to-day.

The Epstein plate is cast with deep grooves on each side, thus combining with a rigid and durable plate a large amount of surface on which the active material is formed.

The Williard plate is made from pure rolled lead and has grooves cut in each side at an angle with the horizontal, forming troughs for holding the active material. It is claimed that the plate can be bent up into almost any shape without dislodging the active material. The thin layer of active material and the large amount of surface allows of rapid discharge with danger of buckling. Each positive plate is enclosed in a perforated hard rubber envelope to avoid contact between plates.

The Ohio storage battery is made of pure rolled lead sheets. Circular grooves 1 inch in diameter and 3/16 inches deep and 1/8 in. thick are raised by rolling in a machine. The different circular grooves are separated by 1/4 inch to avoid any tendency towards buckling.

The Rooney plate is made up of alternate corrugated and straight strips of thin rolled sheet lead placed on edge and burned into a conducting strip or rib of the lead frame at each end. This forms a very open plate with a large amount of surface.

Porous plates have been made by casting lead with powdered coke, or with pumice stone, by the formation of sulphide, the sulphur afterwards being taken out, and notably by the use of chloride of lead and zinc. The object in making these porous or partially porous plates, is to obtain a large amount of surface of the lead plate on which the active material may be found in minute quantities. The great amount of surface with the corresponding large amount of active material insures large capacity, while the minute subdivision of the active material permits of rapid discharge.

In the chloride battery the substance which is to become the basis of the active material is chloride of lead mixed with a certain proportion of chloride of zinc, and cast in small pastelles. These pastelles are then placed in a mould and a frame of an alloy of lead and antimony cast around them under great pressure. The antimony gives strength and hardness to the grid, and it is claimed is not acted on by the acid, thus avoiding local action. The grids are then packed between zinc plates in a tank containing a dilute solution of zinc chloride, and short circuited. This removes most of the chloride from the plate, the last traces being removed by thorough washing, leaving a pure spongy lead. This process was formerly used for both plates, but is now used only on the negative. The positive plate is obtained by casting the lead antimony grid under pressure, 1/8 in. thick, and with holes 3/4 in. in diameter. A corrugated ribbon of soft pure lead is rolled up into a spiral and pushed into these holes. The active material is formed electro-chemically from this ribbon, and causes it to expand and fill the hole tightly, making good electrical contact with the plate.

The method of formation of all these plates is quite different than that followed with the early Plante cells. The method is different with almost every manufacturer, but the object aimed at is similar in each case, namely, to form the cell quickly and avoid the tedious and expensive method of numerous charges, discharges and reversals, and at the same time procure a hard and durable plate. The plates are usually pickled in a bath of dilute nitric or acetic acid, or in some alkaline solution capable of acting on the lead until the action has penetrated to a sufficient depth, after which the coating produced is reduced to a spongy lead, or changed to lead oxide. The plate is then formed in the usual manner by charging. The cell never attains to its full capacity on the first charge, but will increase with successive chargings for quite a period of time.

The Faure, or pasted type of plate, has likewise been subjected to numerous modifications. Metzger used a perforated lead box filled with the active material; Faure spread his active material on the surface of a lead plate. The difficulties of the first were principally the great expansion due to so large a body of active material, the necessarily slow rate of discharge since the tendency of the action is from the surface inward, the poor electrical contact, etc. The difficulties of the second were principally due to the insufficient adhesion of the active material and the consequent poor electrical contact, danger of short circuits from falling of active material, and the rapid deterioration. These difficulties have been largely overcome by sub-dividing the active material and placing it in small pockets or grooves in the surface of the plate, or in holes extending through the plate. The pockets or holes are usually made smaller at the surface than in the interior, so as to wedge the active material in place, or in the case of grooves, they are made narrow, so that the plate will have a good grip upon the active material.

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*Paper read before the Peterborough Engineering Club by C. E. Brown, of the Canadian General Electric Company.

One of the most fruitful sources of trouble with storage batteries has been the tendency of the plate to buckle or bend out of shape with operation. This has been very largely overcome in the better modern batteries, and is no longer a source of serious trouble. The active material of the positive plate expands during discharge, and as the action on the material is never uniform, some portions will expand more than others, and tend to throw the plate out of shape, and the more rapid the discharge the greater will be the tendency. The remedy is largely in subdivision of the active material and allowing opportunity to expand in one direction. A brief description of a battery which has achieved considerable success on the continent of Europe, the Tudor battery, will serve to illustrate this class of plate.

The plates are made from pure rolled lead about ⅜ in. thick, and are grooved on both sides, the grooves being about ⅛ in. wide and a little greater in depth. These plates are first slightly peroxidized by electrolysis, forming PbO_2, and then the grooves are packed with oxides of lead, after which the plate is rolled to keep the active material in place. As the active material crumbles away, due to continued use, the action penetrates deeper into the metallic lead of the plate and keeps up the supply of active material, so that the full capacity of the plate will be maintained, even though the active material at first pasted into the grooves should entirely fall away.

The numerous small sections of the active material insures a large surface and permits of a high rate of discharge. The smallness of the section of active material prevents excessive swelling and consequent buckling of the plate. The method of formation gives unusually good electrical contact between the active material and the frame. Perforated sheets of hard rubber are inserted between the plates in this as in most batteries.

Numerous attempts have been made to reduce the weight of the battery by increasing the proportionate weight of active material. Among these are the use of porous earthenware containing plates to support the active material and press it against a thin sheet of lead, which serves to carry away the current, an earthenware plate being placed on each side of the lead sheet to form one plate and all plates firmly bound together with rubber bands. Wool felt has been used in strips to form pockets on each side of a sheet of lead, and the pockets filled with the active material, which is kept in place by a light sheet of perforated or porous insulating material, the various plates being bound tightly together. Perforated cells, or envelopes of celluloid filled with active material, are used for electrodes, the current being taken out by lead wires or strips passing down the center of the cell or envelope. So far as I know, none of these batteries have proved a real commercial success, except for traction purposes, where lightness is so important a consideration that some other considerations will be sacrificed to obtain it. One serious difficulty with this class of cell is the rather poor electrical contact between the active material and the lead plate, which lends itself to the formation of the insoluable lead sulphate on the surface of the lead, limiting further action by its insulating properties. The electrolyte for the lead storage battery is always dilute sulphuric acid. The proportion of acid to water is usually determined by the specific gravity of the combination and is used from 1.2 to 1.3.

In pasted or Faure type of plates red lead minium (Pb_3O_4) is generally used on the positive plate, and litharge (PbO) on the negative plate. Combinations of these oxides or other compounds are sometimes used. In some later batteries a mixture of lead sulphate and lead oxide is used. Lead is not the only metal that has been used in storage batteries, copper and zinc both having been used, but, as these batteries have never achieved any marked success commercially, they will not be discussed here.

The chemical theory of the storage battery is still, to a large extent, in the speculative stage. To the outsider it would seem an easy task to analyze the various elements entering into the action before and after charge and discharge, and determine the actual reactions that take place. When, however, the chemist approaches the task it is found to be one of extreme difficulty, so difficult that after 15 or 20 years of research and persistent effort to solve the problem, it is still, to a large extent, shrouded in mystery as to the real nature of the reactions that take place. The difficulties were expressed by Dr. Frankland in the following words: "The physical qualities of the cells are capable of very accurate estimate and investigation, but, when you come to attempt to ascertain the chemical charges that occur in charging and discharging of a storage cell, you encounter formidable difficulties. The outsider has no idea of these difficulties. Nothing seems more simple than to determine the chemical changes that take place in either the positive or the negative plate of a storage battery. It is not so in reality. The substances used as active materials are in the first place mixtures, and the materials obtained at the end of the reactions are also mixtures, and these mixtures are insoluable in any reagent which does not decompose them. They cannot be volatilized; they cannot be subjected to any process of solution and crystalization in order to separate and purity their elements." This will give you something of an idea of the difficulties in the way of an exact determination of the nature of the actions taking place.

The earlier ideas of the action of the storage battery were somewhat vague, and it was spoken of by no less an authority than Maxwell as storing up a quantity of energy in a manner somewhat analagous to the ordinary condenser. The first definite chemical theory was what is known as the accluded gas theory, namely, that the active material of the electrolyte is the water, and that this is decomposed in charging into its two components, oxygen and hydrogen gas, the oxygen being liberated at the positive and the hydrogen at the negative electrode where they are occluded by the electrode. The discharge would be the reverse action, the two gases reuniting in the formation of water. In this theory the sulphuric acid serves only the purpose of increasing the conductivity of the electrolyte. This theory is disproved by the fact that it only requires about 1.5 volts to electrolyze water between platinum electrodes, and therefore only 1.5 volts could be obtained by the reunion of its constituents in discharge, whereas the actual voltage of the storage battery is about two volts during the greater part of the discharge. It would be necessary to presuppose some other action than mere occlusion at the electrodes to account for this extra voltage. It was also observed that action did take place on the electrodes, the negative being reduced to metallic lead and the positive peroxidized during charge. These effects were attributed to local or waste actions. This theory is, I believe, still accepted by some authorities. It is, however, now generally discredited.

About 1882 the double sulphating theory was advanced, and this theory, with modifications and additions, despite considerable opposition, is the one generally accepted to-day. According to this theory, sulphate of lead (P_6SO_4) is formed on both electrodes during discharge, accompanied by the withdrawal of sulphuric acid (H_2SO_4) from the electrolyte and its replacement by water, H_2O. In charging the sulphate on the negative electrode is reduced to spongy metallic lead, and on the positive to peroxide of lead (P_6O_2) with the formation of sulphuric acid and the withdrawal of water from the electrolyte. These reactions, beginning with the charged condition, may be represented by the following equations :

For the positive plate : $P_6O_2 + H_2SO_4 = P_6SO_4 + H_2O + O$.

For the negative plate : $P_6 + O + H_2SO_4 = P_6SO_4 + H_2O$.

Combining these negatives we have : $P_6O + 2H\ SO_4 + P_6 = P_6SO_4 + 2H_2O + P_6SO_4$ for the entire cell.

It is quite certain, however, that the action is not as simple as represented in these equations, but they seem to represent the net result of the normal action of the battery. It should be remembered that these equations do not represent the entire material of the cell, but only those parts actually entering into chemical reactions. This includes only a small percentage of the electrolyte and by no means all of the active materials. The action is, fortunately, and it might also be said unfortunately, a self limiting process ; unfortunately, because it limits the output of the cell to only a portion of the active material ; and fortunately, because if the active material were once entirely converted to lead sulphate it would become non-conducting and non-electrolizable, and it would be impossible to reverse the cell and again charge it. When the peroxide is reduced to about 31 per cent. of the original amount on the positive plate, action will cease entirely. The voltage begins to drop so as to make further discharge undesirable considerably earlier.

The charging process is substantially the reverse of this, but there seems to be some slight difference or extra action, as, after making all allowance for resistance drop, the charging voltage is somewhat higher than that of discharge ; and the sudden rise of voltage as the cell becomes charged and sudden fall at the end of discharge would seem to indicate some further irregular actions.

The attempt has been made to explain all these variations of voltage as due to variation in the density of the sulphuric acid within the substance of the active material. It is well known that the voltage of the cell increases in some degree with the increase in density of the electrolyte. Then, as sulphuric acid is formed during charge and withdrawn during discharge, it is evident that the density of the electrolyte is greater or less within the active material of the electrode direct, as the lack of porosity prevents complete diffusion of the electrolyte. The sudden rise in voltage at the end of charge and the sudden fall at the end of discharge might be explained by the decrease in porosity of the active material at these stages, causing greatly increased density of the electrolyte in one case and greatly decreased density in the other. Whether this explanation is sufficient to account for all variations in the voltage is not entirely clear.

Another, and perhaps more plausable theory to account for the rise in voltage at the end of charge, is the formation of persulphuric acid $H_2(SO_4)_2$. This is supposed to be brought about by the sulphion (SO_4) combining with the sulphuric acid in the absence of more available lead to unite with. This combination is very unstable and almost immediately breaks up, with the following result :

$H_2(SO_4)_2 + 2H_2O = 2H_2SO_4 + H_2O_2$.

$H_2O_2 = H_2O + O$.

This not only accounts for the rise in voltage, but also for the abundance of oxygen passing off when the cell becomes fully charged. The double sulphation theory is supported by the following facts : The thermo chemical equivalents of the combinations claimed would just account for the voltage observed on discharge ; the increase in density of electrolyte during charge and decrease during discharge, which are well known phenomena, and the formation of lead sulphate during healthy operation, which seems to be unquestioned. These are the more important points in support of this theory, which seems to have no formidable rival at the present time.

The efficiency of the storage battery as obtained by laboratory tests under favorable circumstances is about 80 to 85 per cent. It is doubted if it often exceeds 70 to 75 per cent. under actual commercial conditions. This difference is due to leakage, to local action, to the cells not being kept in the best conditions, and to several other causes not occurring in laboratory tests. The losses occurring in normal action are divided by Crosby and Bell as follows: 1st, the direct losses due to heating; 2nd, the losses due to local action between the supporting grid and the active material; 3rd, the losses due to local action in the active material itself; 4th, the losses due to unreversed chemical action. The first is the C^2R loss and has been reduced to quite a moderate figure in modern cells. The second is not a very serious loss in well designed cells except in cases where cells are required to stand for quite a period of time partly discharged. The third and fourth are usually the most formidable losses. The third can be reduced to some extent by subdivision of the active material, but apparently can not be eliminated. It is due largely to unequal action in the active material, and the most rigid uniformity in manufacture will not prevent this. The fourth is partly due to the formation of irreversible chemical compounds and partly to those electrolytic actions which produce free hydrogen, oxygen, ozone, etc. There seems to be no method of effectually limiting these losses. Omitting the C^2R loss, these wasteful losses have been found in some tests to be as high as 17 per cent. of the entire energy put into the cell in charging.

The theoretical value of lead peroxide has been calculated at 4.48 grammes per ampere hour, or approximately 100 ampere hours per pound. Assuming the weight of spongy lead on the negative plate to be equal to the weight of peroxide on the positive, this would give 50 ampere hours per pound of active material. Plates of the highest capacity yet manufactured do not, however, give more than 16 ampere hours per pound of active material, and as the active material forms but from 20 to 50 per cent. of the weight of the plate, the ampere hours per pound of plate will be about three to seven or eight in the best commercial cells. These figures are comparable to the efficiency of the steam engine calculated from the heating value of the coal. They suggest the great possibility of improvement, but as in the case of the steam engine, there are natural laws which prevent the complete utilization of this energy.

The Electric Storage Battery Company names the following useful applications of the storage battery: Central station lighting; central station power; trolley regulations; isolated lighting; street can traction; electric locomotives; electric launches; electric carriages; electric elevators; train lighting; telegraph and telephone, and many others which I will not mention here. Some of these applications will be discussed somewhat in detail, but before taking up these applications it may be well to state some of the general considerations which make the application of the storage battery desirable or undesirable. The storage battery is not a prime mover. It must receive its energy from some other source, store it up, and give it out again as required. It is, therefore, as regards economy, suitable for those uses only in which it can receive its energy at some time or place where energy can be had more cheaply than at the time or place that it is required to be used. For example, in the central station power can be produced generally far cheaper at the hours of minimum load than at maximum, and this is just as true for the momentary fluctuation as for the all day load curve. For these reasons the storage battery is not well adapted to service where steady continuous loads are required, except in cases where the energy is small or as reserve of great reliability. This class of service is better served directly from the prime mover. The use of a steam engine during four hours of the day to charge a storage battery which is to firnish light and power for the remaining 20 hours is not often an economical operation, however convenient it may be. On the other hand, the storage battery is well suited to loads having sudden fluctuations or of short durations. A single case will illustrate this. The battery installed by the Chicago Edison Company is rated at 22,400 ampere hours for an eight hour discharge, or at the rate of 2,800 amperes. It is quite safe to say that generating machinery rated at 2,800 amperes, including boilers, engines, feed pumps, dynamos, etc., could be installed for less money than this battery cost. But whereas the generating machinery might safely carry 4000 amperes for one hour, probably not more, the battery is guaranteed to deliver 11,000 amperes for one hour, a ratio of $2\frac{3}{4}$ to 1 in favor of the battery, and far more than enough to overcome the difference in first cost; and the battery actually does deliver considerable more than its guaranteed rate, reaching 14,000 to 15,000 amperes for short periods.

The uses to which a battery can be applied with advantage have been stated as follows: 1st, to carry the peak of the load at maximum hours; 2nd, to carry the entire load at minimum hours; 3rd, to act as equalizer or reservoir; 4th, for the equipment of annex stations. The first of these uses is the one which is generally of the most importance in illuminating stations, though the fourth is of considerable importance in many cases. The first, third and fourth are of about equal importance in railway work. The second is not much used on this side of the Atlantic in connection with steam plants.

Coming back to particular applications, we will endeavor to point out some of the ways in which the storage battery has made, or is making, itself useful. One of the applications in which it has met with undoubted success, but of which we hear little, is in connection with telegraphy. With great conservatism the telegraph campanies clung to the primary battery long after it had been superceded by the generator in almost every other commercial application. The generator is not, however, well adapted to this class of work directly, except in very large equipments where the amount of energy consumed is quite large and the extra cost of complete reserve equipment is not prohibitive. It becomes, then, a question largely between the relative merits of the primary and the secondary battery, and a fair trial is all that is required to establish the great superiority of the latter in practically all cases where charging current is available. Its advantages over the primary battery may be stated briefly as follows: Its first cost is 75 or 80 per cent. of that of the same capacity of primary batteries; its maintenance, including cost of current for charging, 10 per cent. It should be added that this is the important item, as the maintenance cost of primary batteries per year is from two to three times the first cost, floor space from 15 to 25 per cent., and far more satisfactory operation. It would seem that the storage battery has before it a great field for expansion in connection with the telegraph; and what has been said with regard to the telegraph is in a large measure equally true for the telephone, for fire alarm systems, and other similar classes of work.

The electric lighting of railway trains from the storage battery, or with storage battery auxiliary, offers the most satisfactory solution of the difficult problem of train lighting yet presented, but has not always proven the most economical. The method of application follows two lines. Where the run is short or of moderate length, say from 5 to 12 to 15 hours, a battery of sufficient size to carry the load of the train for one trip is installed on one car, or more often it is sub-divided and a battery placed on each car. This battery is then charged in the train yards at each end of the run, or removed and a fresh battery put in place. For long runs of many hours, or perhaps days, this method cannot be used except by establishing stations along the line for recharging batteries which are exchanged at these points. For this class of service a generator may be installed on the train and the lighting current obtained directly from it, the storage battery acting as a reserve to take the load when the locomotive is uncoupled, or at all stops and times of slow speed, if the generator is run from the car axle. For the man who reads his newspaper on the train, the better distribution of light by numerous electric lights will fill a long felt want, and the user of the sleeping car, after a brief experience with it, will wonder how he ever got along without the berth light. One of the best illustrations of train lighting is in the case of the Chicago, Burlington & Quincy Railway, between Chicago and Minneapolis. These trains have been lighted by storage batteries for about three years, and they have given perfect satisfaction. The trains referred to are said to be the finest in the world. Each car is equipped with a battery, the batteries all running in parallel. They are charged while the train stands at the station at each end of each run, and no time is lost by the operation. The trains make one trip daily, which occupies 14 hours. The cars are equipped with from 25 to 75 lights, each according to the nature of the car, and each berth in the sleeper has its frosted globe lamp. The expense of lighting this train has been a little greater than it would have been with oil or gas, but the travelling public once having become accustomed to this quality of lighting will not readily put up with anything inferior.

In the larger field of storage battery auxiliaries to central stations, both light, power and railway, we will find that the determining question in the installation of such batteries is does it pay—will the investment in storage battery yield a larger dividend, or will it cost the station as a whole to yield larger dividends than the same investment in generating machinery? and this question must be answered for each individual station. The use of a battery as a reserve in case of a necessary shut down, or as a means of steadying the buss bar voltage, is important, but batteries are seldom installed principally for this purpose, they are installed to earn dividends. From the largely increased number of plants installed in the last few years, since the system has been fairly tested, it would seem that they have succeeded in earning dividends in a large number of cases. After the installation of the first battery by the Boston Edison Company, Mr. C. S. Edgar, of that company, stated the case which confronted them and the results obtained somewhat as follows: The peak of their load represented 50 per cent. of the total load at the time of maximum, but only 10 per cent. of the total output for the 24 hours. It became necessary to provide some means of carrying this peak of the load owing to increasing output. If a steam plant were installed to carry this 10 per cent. of the output, it would require a plant of equal capacity with existing steam plant, the existing plant carrying the other 90 per cent. without difficulty. It was found that a steam plant of the required capacity would cost $65,000, a battery plant complete could be installed for $50,000. The battery was installed with a guarantee to be kept in good working order for 6 per cent. per annum on cost of cells. The battery improved the load factor greatly, and it became possible to run the generating machinery at a load never less than 75 per cent. of the rated full load. This, of course, reduced the operating expenses and brought up the efficiency of the steam plant. It has been found by careful records that the losses in the battery are offset more than four fold by the reduced losses in the generating machinery, because of the higher efficiency of operation with the higher load factor. The results, then, in this particular case, show lower first cost, lower operating expenses, and a depreciation at least as low as could have been obtained with an equivalent steam plant. This appears to be fairly typical of the results to be obtained in most illuminating stations of large or moderately large capacity. The load curve in these stations has a peak of short duration which is quite a large percentage of the load, and which is very expensively and inefficiently carried by steam generating machinery. It is interesting to note that the Boston Edison Company now has four batteries installed, and that their generating machinery, which is of the best multipolar type, has a rated capacity of less than 50 per cent. of the load on the station at the peak of the load curve, and carries 90 per cent. of the total output of the station directly. In railway power stations it is not alone the peaks that need looking after, but also the sudden variations or fluctuations which so often limit the output of the generator to an average far below the rated capacity. The purpose of the battery in street railway power stations is to carry the peak of the load when it comes, to charge when the load is light, and to take the fluctuations at all times, charging at one moment and discharging at the next, so that the load on the generating machinery remains nearly constant. This use is quite similar to that already deseribed for illuminating stations, except that it is necessary to keep the battery floating on the line during the whole time it is used for equalizing the fluctuations. Another class of work quite different from this is the use of battery sub-stations on lines extending a long distance from the power station and on which the drop becomes excessive at times of heavy load. There are several methods of taking care of such cases—putting in sufficient copper in the feeder to keep the voltage up, installing separate steam plant at the location needed, the use of a booster and separate feeders for that line, or a storage battery sub-station. The first of these remedies is usually the most expensive. The second gives the highest operating expense, and the third, though often the cheapest, is necessarily of very low efficiency, often under 50 per cent. Without entering into the evidence on either side, it is sufficient to say that in many cases the battery offers the most satisfactory solution of the problem. For this class of work the battery is generally connected directly across the line without booster or other apparatus. It is calculated for a voltage equal to the voltage on the line with the average load. When the load is less the drop will be less and the battery will charge. When the load is greater the drop will be greater and the battery will discharge, thus taking nearly constant current over the feeders at all times, the conditions of maximum economy.

A rather novel case of this use of the storage battery is found in connection with the Brooklyn Heights Railway Company. On their Coney Island line the traffic is very heavy for three or four months in the summer and is practically nil at other seasons. For this service they have installed on six freight cars a large battery which is run out and connected up near the end of the line in summer time. When the season is over the battery is run back to the station or to any point on the line where it will be the most serviceable.

It is often thought that a battery is only applicable to large stations, but a little enquiry will show that very beneficial results can often be obtained in small stations. In Peekskill, N. Y., the Street Railway Company operates 4¾ miles of track, running from three to five cars. With the five car schedule the fluctuations are from zero to 310 amperes at 575 volts, or 178 k.w., yet this load is carried on a 60 k w. generator, with the assistance of a battery rated at 160 amperes for one hour, and a small differential booster operating automatically, and the load on the generator is practically constant at about full load. The curve of generator and battery load will explain more than any words. The saving in generator capacity and the increased efficiency of operation will be apparent at a glance.

Before leaving the subject of central station batteries, it may be well to sketch briefly the methods of operation in these plants. In illuminating stations the use of end cell switches is almost universal. The battery terminals for a number of the end cells (this number being as high as 30 for the Chicago Edison Company) are carried to the switch-board and connected to a set of contact bars. A moving switch or contact piece, connected to one line or busbar, travels over these terminals, thus cutting in or out cells as required to give the required voltage. This arrangement is usually operated electrically and is semi-automatic.

A switch must be closed by hand, which starts the moving contact to cut in or out cells as desired. This contact once started cuts out one cell and then stops, and cannot be stopped sooner. If this effect is not enough the switch may be closed again and so on until as many cells are cut out as desired. The object of this arrangement is to prevent the switch stopping on two contacts and thus short-circuiting a cell.

For street railway work it is necessary to have some automatic means of regulating the voltage on a battery, as the fluctuations are so sudden that no hand operated method could possibly answer the purpose. Railway generators are invariably compounded, and if the battery were connected directly across the busbars, their load would increase directly as the load on the system increased and only aggravate the trouble they are intended to overcome.

The general arrangement for this class of work is to use a differential booster. This is a generator wound with a weak shunt field and a very strong series field. The series field is connected in opposition to the short field and in series with the line. The armature is connected in series with the battery and in such direction that the voltage generated by the shunt field opposes the battery voltage and the voltage generated by the series field assists it. The adjustment is so made that when the load on the line is normal the booster voltage will be zero and the battery neither receives nor gives current. When the load on the line falls, the voltage of the booster in opposition to the battery rises on account of the shunt field overcoming the series, and forces current through the battery, charging it and keeping up the load on the generators. When the load on the line rises the voltage of the booster rises, assisting the battery voltage, due to the series field overcoming the shunt and the battery discharger relieving the generator of a part of the line load. If it is found at any time that the battery is discharging faster than it is charging, a slight turn of the shunt field rheostat will bring up the shunt field and give the battery more charge and bring a slightly larger load on the generators, or vice versa. This arrangement when once adjusted works with great satisfaction and regulates the load on the generator with great constancy.

There is one other application in connection with central stations which I wish to mention. I refer to the use of the storage battery as a substitute for the usual isolated station, in office buildings, large stores, etc. The load in these buildings is usually quite large for a short time and relatively small during the remainder of the day. The time of maximum load coincides with the peak of the central station load, so that they are unprofitable customers when served in the usual way, hence the isolated stations are so generally installed. By the use of storage batteries these buildings may be cut off from the station entirely during the hours of its maximum load, the storage battery carrying the entire load of the building. During the remainder of the day the battery may float on the lines, acting as a regulator for the elevators and charging when the station load is a minimum. In one particular case the illuminating company was ready to furnish power for this method at 4½ cents per k.w. hour, when their price for the usual method was 13 cents. The cost of battery will not differ much from the cost of a steam plant with direct connected units, and it is quite certain that the operating expenses would be less in most cases. There would seem to be an extensive field in the larger cities.

I had hoped to take up the subject of storage battery traction at some length, but owing to the lack of time and the length this paper has already assumed, I will dismiss it with a few words. Technically speaking, the storage battery street car has proved an entire success. The various difficulties that have loomed up from time to time have been satisfactorily settled, and lines have operated for months giving as good service as could be asked. But the proof of the pudding is in the eating, and as these roads have generally been abandoned after a period of successful operation, there is but one conclusion, namely, they have not been a commercial success.

The automobile is not so easily disposed of. It seems to be a settled thing that there are to be automobiles, and quite a good many of them in the near future in the larger cities. Shall they be electrics or some other kind, gasoline or steam? The points in favor of the electrics are briefly about as follows: Extreme simplicity in construction and operation; entire freedom from danger of explosion or fire and from smoke, disagreeable odors, excessive oil and dirt, etc.; low operating expenses as compared with horse traction in the larger cities. The points against them in the comparison are: Great weight of battery and consequent limit of grades that can be ascended; large first cost; limit of operation to a certain radius from the charging station to which it must return for a new charge when its supply is exhausted.

These objections, though prohibitive of the general adoption of the electric automobile at the present time, are not so serious against city service as would at first appear. The electric can mount a grade of 12 per cent., and this is as steep as will often be encountered on city streets. The first cost is not greater than that of horse carriages used for city driving purposes, with a suitable driving team. With the multiplication of automobiles, charging stations will be established all over the larger cities and well out into the surrounding country, so that no difficulty will be experienced in obtaining a charge once they are in general use. In spite of the difficulties in the way, I have considerable faith in the ultimate triumph of the electric automobile in a somewhat limited field.

TRADE NOTES.

The Robb Engineering Co. are building a 250 horse power engine for shipment to Calcutta, India. The order was received through their representatives in London, Messrs. Dick, Kerr & Co.

The Central Electric Company, of Portage la Prairie, Man., have just installed and placed in operation a 150 k. w. S. K. C. two phase alternator. They contemplate going into the power business.

The War Eagle Mining Co., of Rossland, B. C., have placed their order with the Royal Electric Company for one of their two-phase 20 h. p. S. K. C. induction motors. This is one of a series of motors that will be installed by these people for small power purposes in and about their mines.

The Hutton Electric Company, of Brampton and Huttonville, who had their plant destroyed by fire last spring, and who have been operating temporarily since, have purchased from the Royal Electric Company one 1500 light alternating current generator and one 50 light arc machine. These are in use at the hydraulic power house at Huttonville.

The Atlantic Grindstone Company, of Providence, R. I., who purchased the grinstone quarry at Lower Cove, N. S., some months ago, intend equipping the quarry with modern machinery and largely increasing the output. The power will be supplied by two 125 horse power Mumford boilers and a 250 horse power Robb-Armstrong engine, which are being built by the Robb Engineering Company.

The Perth Water & Electric Co., who have been operating their water system by electrically driven pumps from their lighting station, where they have had a 150 k. w. S. K. C. generator in operation for the past two years, have found it necessary to increase their plant both for power and light, and have placed their order with the Royal Electric Company for one of their 200 k. w. S. K. C. two phase generators, which is being installed to work in parallel with their present outfit.

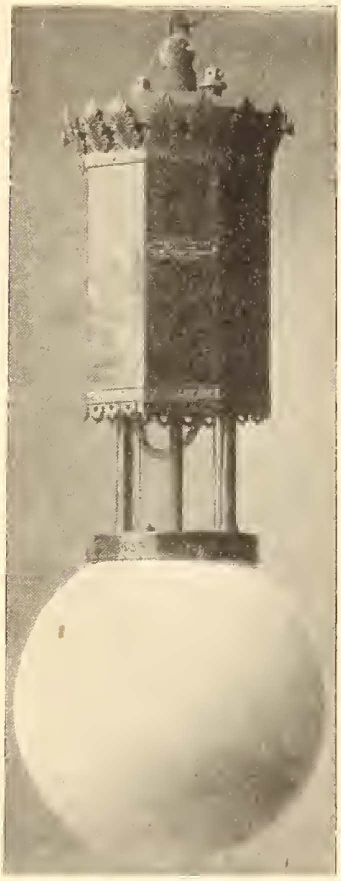
The Canadian Oak Belting Co., of Montreal, have removed their belt factory to Brockville, Ont., having purchased the tannery there formerly owned by McLaren & McCrady. This tannery is equipped with modern appliances for turning out a superior quality of oak tanned leather, especially suitable for the manufacture of leather belting. The tannery and belt factory will be under the management of Mr. J. B. McArthur, who has had twenty-eight years' experience in the business. They will continue their office at 771 Craig street, Montreal.

Messrs. Fair & Sargent, of Bancroft, Ont., are about to put in an electric light plant in that town. They have placed their order with the Royal Electric Company for two direct current generators, with a capacity of about 500 lights, also the necessary supplies. Messrs. Fair & Sargent certainly are enterprising and deserve success in their venture. They expect to have the lights in operation by Christmas.

NEW ALTERNATING ARC LAMP.

The accompanying illustration is of a new alterating arc lamp, the inventors of which are Messrs. F. W. Martin, station superintendent, and Frank Stewart, of the Hamilton Electric Light & Cataract Power Co., of Hamilton, Ont.

The lamp as shown has an octagon bonnet, nicely oxidized. The lamp is less than 30 inches long, and looks very neat and attractive. It is for ordinary use, such as for store lighting. Altogether, this lamp is designed in eight different styles, some for office or warehouse use, some for factory, and some for outdoor types, the idea being to give a range in prices in the different styles and finish. One of the features of the lamp is its long life ; using a ½ inch carbon it is claimed a lamp will burn with safety between each trimming fully eighty hours. It is very easily trimmed. The trim spring holds the chamber tight to the gas check. To trim the lamp this is pulled down to release the chamber and the carbon put in, very much the same as an old style D. C. lamp. The lamp has a carbon rod which is used on account of the difficulty sometimes found by using a carbon feed. Any uneven or slightly crooked carbon will not stick. The carbon rod allows the lamp to feed more evenly.



NEW ARC LAMP.

The make of the lamp is simple, yet it is strongly constructed so as not to get out of order. The carbons are controlled by a single magnet coil, which has a sheath or iron cover. This cover both strengthens and makes it more efficient, and keeps the coil cool. Opposite the magnet there is a dash pot which allows an easy pick-up when the lamp is starting. The current is adjusted through a reactive coil, and the lambs ordinarily are adjusted to five amperes, unless otherwise ordered.

The inventors have assigned an interest in the lamp to the well known firm of Brown, Boggs & Co., of Hamilton, Ont., who already have filled several orders, and the encouraging results have warranted them in adding an additional three storey building to their factory, which is nearing completion, and they will then be in a position to meet the demand which is being experienced for these lamps.

AMALGAMATION OF ELECTRICAL INTERESTS.

Negotiations have been under way for some time looking to the absorption by the Canadian General Electric Company of the manufacturing department of the Royal Electric Company at Montreal. No official announcement has been made, but it is believed that the deal has been closed. In all probability the extensive works of the Royal Electric Company at Montreal will continue to be operated. The Royal Company will devote its attention exclusively to the light and power business, the intention being to develop the Chambly power to its full extent.

MORE LIGHT WANTED.

MONTREAL, Nov. 15, 1900.

Editor ELECTRICAL NEWS :

On page 214 of your November issue mention is made of Messrs. Strickland & Company's "Persuader." Do our good friends object to throwing a little more light on the subject ?

Yours truly,

"WIREMAN."

TESTS OF LIGHTING APPARATUS.

SCHOOL OF PRACTICAL SCIENCE,
TORONTO, December 4th, 1900.

Editor ELECTRICAL NEWS :

SIR,—In your last issue, on page 207, there appear some comments on "Street Lighting in Toronto" which bear special reference to a series of tests which we have made at the School of Practical Science, for the city, on the various appliances offered under tender to the city for street lighting, and to our reports on the tests. You say truly that our task was not an easy one; and we doubt whether in a short statement it is possible to explain the points involved, but as some of the comments in the article referred to seem not to put the question quite fairly, we wish here to refer to them. The first portion of our report gave detailed information with regard to the light obtained from each of the nineteen different appliances, and its distribution in the various directions, the supplementary portion was prepared in order to meet the requirement of a comparison between the illumination of the streets and the cost of the same in the case of each illuminant; it was not intended to be considered separately. Referring to Palaz' treatise on "Industrial Photometry, with Special Application to Electric Lighting," translated by Paterson, page 294, we find the opinion given, supported also by other authority, that in the lighting of large open areas the mean illumination as well as the minimum should be taken into consideration.

In the second portion of our report we have done this, the first column, the price per candle power, giving information as to mean illumination, and the second the cost per mile lighted up to a given minimum of illumination. Compared in the latter way the results must naturally appear less favorable to all high candle-power lamps, for sub-division of light necessarily improves the minimum illumination. Also from this point of view the arc light is under the disadvantage that the ray which is effective on the roadway at the point of its least illumination (somewhere near 10 degrees below the horizontal, depending on the distance assumed between lamps) is of comparatively low intensity. On the other hand, the arc light makes an excellent showing in the first column (cost per candle), already referred to. It seems not unlikely that these figures may appear "contradictory and misleading," but the fact is that the subject is by no means simple, and there is room for considerable difference of opinion as to the proper method of valuing street illumination.

Referring to the "hydrocarbon lamp with special reflector," the article states, "It seems strange that while on the basis of cost per mile such a favorable showing is made for the hydrocarbon lamp with special reflector the cost of candle power should have been omitted in respect to this particular type of appartus only." There is, however, nothing strange about this omission ; the reason this test was asked for was to determine the effectiveness of the reflector for its purpose, a matter fully described on page 11 of our first report. To determine the "cost per candle-power" the mean hemispherical candlepower would have been required. This would have necessitated several hundred more settings of the photometer and have involved much extra work, more, in fact, than time permitted. The value of the quantity, however, cannot be very different from that for the same lamp without the reflector. Again, it is stated that "it is unfair to calculate on the basis of cost per mile of illumination, particularly with the special reflector which throws most of the light in one direction, as most of the lights on the streets of Toronto are on street corners and diffuse light north, south, east and west." The lamp referred to was offered as a tender for low candle power illumination in competition with the Consumer's Gas Company. Of the gas lamps now on the streets, numbering about 960, only about one-quarter are at street corners, so that the question of the allowance for street corners in the case of these lamps is of much less importance than one would be lead to suppose from the statement quoted. The statement can perhaps fairly be used of the arc lights, of which we understand that about two-thirds are on corners ; this, of course, gives them the advantage of lighting two extra spaces on cross streets by means of two out of three lamps, or altogether five spaces with three lamps, thus reducing the average cost per mile to 60 per cent. of what it would be if none were on corners. These considerations, as well as the fact that if lights are to be placed in certain definite positions in any case the total cost is proportional to the price of a single light, are so obvious that we did not consider it necessary to mention them.

Again, we find it stated that "another peculiarity of the report is that the point of illumination at which the tests were made was the minimum for the electric light and approximately the maximum for the gas light." This statement we consider to be particularly unfair to our report, implying as it does that we simply made tests at one point on the lamp, whereas the values given for each of the nine different arc light tests for the mean spherical candlepower were obtained from 66 points each, and the mean hemispherical from 50.

In the first part of the report also the values of the horizontal, the maximum candlepower, and that 10 degrees below the horizontal, are stated in each case. Further, as to the fact that the ray which strikes the ground midway between lamps (and therefore must be used in calculating the minimum illumination on the street) is but a poor specimen of the rays from an arc lamp, while it is practically of the maximum strength for a gas or mantle light, that is, as mentioned above, simply the misfortune of the arc light. Finally it is stated that "this extra and increasing light at every other point than the maximum was not taken into account at all." Now, this is exactly what was taken account of in the adjacent column, namely, "cost of candlepower," in which account was taken of all light delivered below the horizontal.

Yours truly,
W. H. ELLIS,
T. R. ROSEBRUGH.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building.

MONTREAL, December 7th, 1900.

The late street car accident on Guy street north (Cote de Neiges Hill), caused by the trolley coming off, could have been prevented by having air brake or some similar equipment instead of hand brake, a thing absolutely necessary on long hills of this sort ; further, by preventing the public by some means or other from crowding on the back platform until the front motors are almost lifted off the ground. One thing, however, must be remembered, that the Montreal Street Railway Company were forced to build this line, by our worthy city council, against their protests. The line is only to accommodate a very few persons on all days except Sunday, when the line is better patronized by people going to the Roman Catholic cemetery. It is highly probable that this line does not pay expenses.

The elections have come and gone, and were not of especial interest to the electrical fraternity in Montreal. The only point where they are of consequence is in customs duties, and these have been badly assorted under both regimes as regards electrical merchandise in general.

We hear of the number of new cars which the Montreal Street Railway are going to give us, and of the additional horse-power purchased from the Chambly Company, but we still hang on like flies, and the old joke of " there's always room for one more " still stands good.

When we read on page 214 of your November issue about city electrician L. J. Morgan, of Kansas City, we Montrealers can sympathize with the lot of our veteran city electrician, Mr. T. H. Badger, who no doubt has as much if not more to put up with.

It may interest some of the readers of the ELECTRICAL NEWS to know that the systems of barb wire on top of poles as a protection against lightning, described on page 205, was in use between Montmorency Falls and Quebec long before the Chambly transmission was in existence. It may have differed in detail, but the principle involved was the same, and particulars as to its efficacy can no doubt be procured from Mr. Louis Burran, electrical engineer for the Quebec Light and Power Company.

Three Windsor cars, one with a white lamp, second with a red lamp, and third with a green lamp, was a soul-inspiring sight the other evening. The lamps are supposed to designate the line, but possibly the effect of the elections accounts for the red tinge. Double trucks to cars is a recent novelty here ; in fact, if this sort of thing continues we might possibly expect a seat in the cars at business hours in the near future.

One who has tried to open up business relations with firms in Great Britain states that he " gives it up." The delay is simply out of all question ; the order, be it ever so urgent, is numbered and hung on the fyle to go through in regular order, so that in spite of the preferential tariff orders go to the United States. This is not as it should be, but the fault does not lie with Canada.

One of the hardest pieces of luck was the breaking of the dam at Chambly. To add to it, the following day, when numerous temporary circuits had to be run on the poles by the Royal Company, so as to connect with the Lachine Company's sub-station, where a loan of 1,000 h.p. had been arranged for, the weather was magnificent—rain, snow and freezing following each other. Again, before all the temporary arrangements were fully complete, along came a wind storm of 70 miles per hour violence, blowing down a number of important poles, the property of the Royal Company. Although other companies with outside wires were more or less damaged by the wind, the Royal are especially entitled to sympathy under the circumstances. Their outside corps of linemen have been at it night and day, and it speaks volumes for them that steam was got promptly in the reserve station, lines connected, and incandescent and arcs running as usual practically without intermission.

It is rumored that the deal whereby the Canadian General Electric Company takes over the manufacturing department of the Royal Electric Company is " un fait accompli," and why not? The Canadian General have room and can do it, the Royal Electric want room for extending lighting station facilities, and would get it. It would seem a good move for both parties.

The Electrical Workers' Union is the latest thing out, and they assure the trade that they do not intend to countenance "strikes." What about the one in Ottawa ? or has it no connection with this union in question ? One thing is sure, and that is that although the trade in Montreal seems to be jealous of one another, if any such practice springs up they will combine for mutual protection in that direction, and the strike can have but one ending, i.e., disastrous to the employees. As the winter here makes a very dull season, even if successful in a summer strike, the malefactors could easily be weeded out when the proper time came, and the companies generally notified. The " walking delegate," (if we may assume this as his title) who loafed around the Balmoral hotel for several weeks last summer establishing this union, must have had his expenses paid out of the pockets of wiremen, etc., who could ill afford dues for such purposes. First-class wages and all round work for the year are easily procurable here by thorough, reliable and steady wiremen, but rarely do we find a combination of these three essentials. Let the union bring up the standard of the men and wages will rise without effort on their part. Some of the so called wiremen here, would not be tolerated in the United States for 24 hours.

EVENTS AT MCGILL.

The first meeting of the McGill Applied Science Society for this session was held early in November. A lecture was given by Mr. McNab, engineer of the Victoria bridge, in which he enumerated the difficulties that were encountered in building the bridge and the means that were used to overcome them. A series of advanced lectures for demonstration in the laboratories and for graduates generally has been arranged for. The first of these was given on November 13th, when Prof. Rutherford spoke on " Discharge of Electricity through Gases."

AMERICAN SCHOOL OF CORRESPONDENCE.

The American School of Correspondence, Boston, Mass., has recently added four new instructors to its staff, all of whom are teachers at The Massachusetts Institute of Technology. These are: William S. Newell, boilers ; Joseph C. Riley, machine design ; Walter S. Lsland, steam engines ; and Frank R. Swift, chemistry. The Canadian interests of the school are presided over by Mr. R. R. Miller, with headquarters at Elliott House, Toronto.

SPARKS.

The construction of an electric railway between the villages of Schomberg and Lloydtown, Ont., is said to be an assured fact.

Steps are unde way looking to the introduction of the electric light in Weymou N .S. Leading citizens have agreed to take 250 lights.

It is rumored that Mr. J. A. Shibley, of New York, has made an offer for the purchase of the electric street railway system of Kingston, Ont.

The city council of Toronto is desirous of corresponding with persons interested in the formation of a company to build a system of radial electric railways.

Messrs. Harden & Barber, who are at the head of the scheme to build an electric railway from Brighton to Havelock, Ont., have held meetings in several municipalities recently.

Mr. Geo. McAllister, of Bloomingdale, Ont., has purchased a small water power and intends to generate electric power to be used in connection with his saw-milling operations.

At a recent meeting of the town council of St. Marys, Ont., it was decided to engage a superintendent, electrician, and first and second engineers for the waterworks and electric light systems.

Mr. C. Beck, president of the Penetanguishene and Midland Electric Street Railway, Light & Power Company, is again considering the project of an electric railway between Midland and Penetang.

The Bell Telephone Company are extending their system from Quebec eastward. They have just opened an exchange at Fraserville, and are canvassing other towns and villages with the same object in view.

Negotiations are again said to be under way for the absorption of the Metropolitan electric railway by the Toronto Street Railway Company. Should the deal be concluded, the extension of the Metropolitan road may be looked for.

The Listowel Electric Light Company are enlarging and remodelling their power house and installing a new engine manufactured by the Goldie & McCulloch Company, of Galt. They propose suppplying power as well as light.

Mr. M. F. Beach is erecting a temporary wooden building at Iroquois, Ont., in which he will install an electric plant for operating his mill. In the spring it is his intention to erect a stone and brick power house, in which he may install a plant for lighting purposes.

The Royal Electric Company have reconsidered their decision to close down the electric light plant at Orillia, Ont., and are said to have made a verbal offer to expend $10,000 in extending the plant providing the municipality will give a franchise for a number of years.

The Central Electric Company have submitted a tender for lighting the streets of the town of Portage la Prairie, Man., for the next seven years. It has been suggested that the town inaugurate civic ownership, but it is probable that the offer of the Central Electric Company will be accepted.

Mr. J. Keith-Fisher, of the British Columbia Portland Cement Company, Vancouver, has organized a company of American capitalists to establish extensive cement works near Sydney, on Vancouver Island, in British Columbia. The works will have an ultimate capacity of 2,000 barrels a day, and will be operated by electric power.

The Brantford Electric & Operating Company, who have been operating a 180 k.w. S.K.C. machine for the past two years, have found it necessary to increase their capacity for both light and power, and have just started an additional 360 k. w. S K.C. two-phase generator furnished them by the Royal Electric Co., Montreal. This gives them a total capacity of nearly 600 k.w.

It is understood that negotiations have been practically completed for the purchase by Deane & Shibley, of New York, of the electric street railway, electric lighting, and gas franchises of the city of Bellville, Ont. The purchasers are to extend the railway, to reduce the cost of street lighting to $65 per lamp per year, to lower the price of gas 25 cents to $2 per thousand feet, and to supply 1,000 horse power for manufacturing purposes.

SPARKS.

Mayor Houston, of Nelson, B. C., is advocating the installation by the town of a municipal electric light plant.

The electric light plant at Welland, Ont., owned by Mr. C. J. Page, was totally destroyed by fire on November 26th.

Mr. G. E. Kidd speaks hopefully of the prospects for the construction of an electric railway between Brockville and Ottawa.

Mr. J. F. Webb, of Ypsilanti, Mich., is promoting a scheme for the construction of an electric railway from Windsor to Leamington.

The corporation of Preston, Ont., is considering the advisability of purchasing the electric light plant owned by Wm. S. Fenwick.

The town of Oxford, N. S., is installing a new system of electric lighting, and will do away with their old plant, which is run by water power.

The St. Thomas Street Railway Company, of St. Thomas, Ont., are considering the extension of their road to the lake and in other directions.

The Crow's Nest Pass Coal Co. has ordered a 350 horse power engine from the Robb Engineering Company for its mines at Fernie, British Columbia.

The Ingersoll Power & Electric Light Company have renewed their contract for lighting the town of Ingersoll, Ont., for a furthur term of five years.

The City Council and the Board of Trade of Nanaimo, B.C., are taking joint action to secure the construction of an electric ailway to the Extension Mines.

The shops of the Grand Trunk railway at Point Ste. Charles, Que., will be lighted electrically, the Chambly Manufacturing Company supplying the current.

The Ontario Government is being urged to install an electric light plant in the Parliament buildings, Toronto. It is estimated that the necessary plant will cost about $15,000.

The Institute for the Blind, Brantford, are installing a two-phase K.C.S. motor for power purposes, the current being supplied by the Brantford Electric & Operating Company.

DR. Thompson, of Cavuga, the owner of the electric lighting plant there, and whose power house was destroyed by fire some six weeks ago, is rebuilding, and has placed his order with the Royal Electric Company for a 750 light alterating current dynamo, with the accessories.

Mr. George Sleeman, of Guelph, Ont., is reported to have sold the riget to manufacture the Sleeman fender in the United States, receiving therefor a lump sum and a royalty on each fender manufactured.

The city of Victoria, B. C., recently received the folllowing tenders for an electric lighting plant at the waterworks pumping station: Marine Iron Works, $548; B. F. Sturtevant, Bcston, Mass., $594; Canadian General Electric Company, Vancouver, $800, $850 and $385—three bids; Hinton Electric Company, $475.

The Marmora Electric Light Company have secured an hydraulic power from Messrs. Pearce and are installing a 1000 light alternating current generator, with S.K.C. transformers, etc., from the Royal Electric Company, Montreal. They expect to be in operation before the extreme cold weather sets in.

The Bell Telephone Company have, through the local manager at Galt, Mr. J. N. Taylor, installed a seven station warehouse system for Cowan & Co., a five station for the R. McDougall Co., and a four station for the C. Turnbull Co. The work in connection with the installation was done by Mr. McHugh R. Polson, of the company's staff in Hamilton.

The corporation of the town of Parrsboro, N. S., have taken up the municipal lighting question, and have placed their order with the Royal Electric Company for one 50 k. w. S.K.C. two-phase generator, 500 lights capacity in transformers and wiring supplies. It is expected that the plant will be in operation by the first of the new year.

The Berlin Gas Company, of Berlin, Ont., have renewed their contract for lighting the town for five years. The new contract calls for an all night service. The company recently installed a new Ball dynamo, and are using the latest type of enclosed arc lamps, which are giving good satisfaction. They have forty open and forty enclosed arc lamps.

The Edwardsburg Starch Company, of Cardinal, Ont., whose large factory was destroyed by fire about three months ago, have entirely rebuilt the premises, and are installing a complete electric light and power plant, consisting of two 50 k. w. S.K.C. generators, with switchboards, transformers and motors complete, making it one of the latest and most up-to-date plants in Canada.

The corporation of the town of Newmarket, who four years ago undertook the operation of the electric lighting plant for street as well as commercial lighting, and who at that time installed a complete up-to-date plant, consisting of slow speed condensing engines, S.K.C. generators, and Wood arc dynamo, have found it necessary in order to keep up with the demand for additional street as well as indoor lighting, to increase their plant, and have placed their order with the Goldie & McCulloch Co., of Galt, for a 250 h. p. Wheelock engine, and with the Royal Electric Co. for an additional 100 k. w. S.K.C. two-phase dynamo, with the necessary station accessories and transformers. This town, for its size, will possess one of the most modern and up-to-date plants to be found in Canada.

METERS

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To Officers and Managers of Central Stations:

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PERSONAL.

Mr. J. B. McGovern, of Detroit, Mich., is now in charge of the electric light plant at Mitchell, Ont.

Mr. Geo. W. Thompson has been appointed chief engineer for the T. Eaton Company, Toronto, as successor to Mr. E. J. Philip.

Mr. E. Bent, the first engineer employed in the electric light station at Digby, N. S., died recently at Bear River, where he had established an electric light plant.

Mr. J. A. Cokers, manager of the Bell Telephone Company at St. Johns, Que., has taken charge of the exchange at Cornwall, Ont., and has been succeeded at St. Johns by Mr. Gagnier.

Mr. Robert Maxwell, who has been engineer at the Toronto jail for about eighteen years, recently tendered his resignation on account of ill health. His assistant, Mr. John Brown, has been appointed to the position.

Mr. T. F. Dryden, formerly with the Royal Electric Company, has recently been appointed agent for Western Ontario for the Westinghouse Electric & Manufacturing Company, with an office at 404 Temple Building, Toronto.

Mr. R. Burrows, local manager of the Bell Telephone exchange at Orillia, Ont., has been transferred to Sault Ste Marie. Prior to leaving Orillia he was banqueted and presented with a gold headed cane and valuable rifle.

Mr. Edward J. Germain, road-master for the Toronto Railway Company, is about to leave for Birmingham, England, to accept an important position on the street railway system of that city. On Nov. 30th he was tendered a banquet at McConkey's by the different road-masters of the Toronto Railway Company. Road-master Wallace presided, and on behalf of his colleagues presented Mr. Germain with a beautiful gold locket, suitably engraved.

An electric street railway will likely be constructed from St. Albans, Que., to St. Alban's Bay.

The Hanover Electric Light & Power Company recently installed a new three-phase generator, manufactured by the Canadian General Electric Company, also a new 50 h.p. motor, in addition to the 20 h.p. motor installed a short time ago. They intend putting in a complete new arc system throughout, equipped with the latest type of enclosed arc lamps.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED. THOMSON & CO.
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. **Telephone Main 3149.**

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TO CAPITALISTS AND PROMOTERS.

PUBLIC NOTICE

The Corporation of the City of Toronto desires to have an electric railway system constructed to run to and from the new St. Lawrence market, Toronto, for a distance of 100 miles east, west and north therefrom, said railway system to have six or more main lines, with branches, and a total mileage for the present of 500 miles.

The said Corporation of the City of Toronto will assist to obtain a special Act of the Legislature to incorporate a company under the Electric Railway Act, the Acts respecting companies to supply light, power, etc. (R. S. O., chaps. 199, 200 and 209), and with special powers.

All persons or corporations interested in the formation of such a company, or in the construction of the said railway system by the said company, may obtain full information from Alderman Daniel Lamb, Chairman of the Committee of Works, Toronto, up to the 31st day of December, 1900.

E. A. MACDONALD, Mayor.

Toronto, Canada, Nov. 22, 1900.

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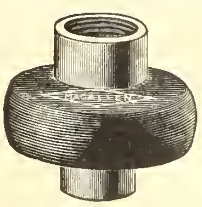

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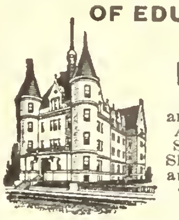

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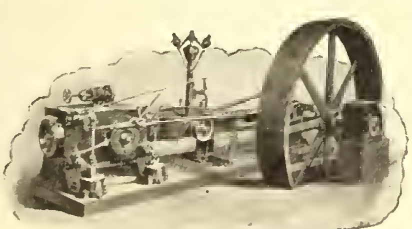

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SPARKS.

Messrs. Pratt & Latchworth, of Brantford, have placed in their new factory a 30 h. p. S.K.C. two-phase motor, which is operated from the lines of the Brantford Electric and Operating Company.

The ratepayers of Woodstock, Ont., by a considerable majority, have voted in favor of raising $30,000 for a municipal lighting plant, $14,000 to purchase the existing plant and $16,000 for extensions and improvements.

The corporation of Brigdewater, N. S., have found it necessary to increase their incandescent lighting capacity, and for this purpose have placed their order with the Royal Electric Co. for one 80 k.w. S.K.C. generator, with the necessary switchboard, etc.

Dr. Groves, owner of the electric lighting plant at Fergus, Ont., has installed in his power house a 75 k. w. S. K. C. two-phase alternating current generator made by the Royal Electric Company, Montreal. The doctor intends to supply power as well as light in the town in the future.

The Bell Telephone Company have installed a new switch-board in the exchange at Parkdale, Toronto. This exchange is designed after the one in Ottawa. A light burns in front of the telephone operator when two subscribers have been connected, and continues to burn until both parties have hung up their receivers again.

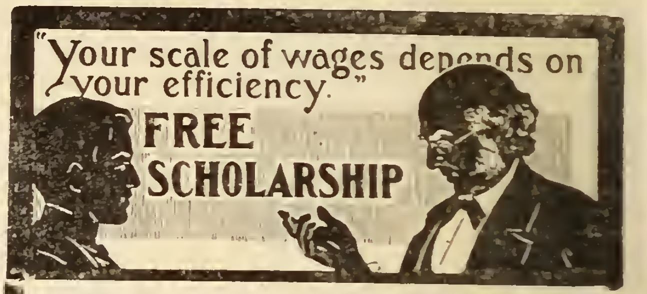
Mr. James A. Spence, of Colborne, Ont., owner of the electric lighting plant, and who had his plant destroyed by fire a short time ago, is rebuilding, and has placed his order with the Royal Electric Company for a 75 k.w. S.K.C. generator, complete with exciter and station apparatus. They were in running order three weeks after the fire

Messrs. Brandon, McDougal & Austin, owners of the Fenelon Falls electric light plant, are increasing their lighting capacity, and have placed an order with the Royal Electric Company for one of their 75 k.w. S. K. C. two-phase generators, as well as for a number of transformers and a stock of supplies, and intend over-hauling and improving their present plant.

The Canadian Gold Fields, Delora, Ont., who own extensive gold mines at that place, have equipped their mines, offices, houses, etc., with electric light and power. They have placed their order with the Royal Electric Company for a 40 k.w. S.K.C. two-phase generator, with the necessary transformers and supplies. They purpose furnishing light to their employees.

The Nickel-Copper Co., of Ontario, whose large refining works are at Hamilton, have begun operations on a large scale, and have placed in their new power house two 240 k.w. and one 75 k.w. S.K.C. generators; the former to drive the dynamos for the electrolytic process and the latter to drive the ore process. These three machines are being used as synchronous motors, taking the current from the Cataract Power Company's lines at 2,400 volts.

Shipment was made a few days ago of the largest motor that has yet been built in Canada. The motor was consigned to the British American Corporation, of Rossland, B. C., and the shipment made by the Royal Electric Company, Montreal. The motor is an S.K.C. two-phase machine, and its capacity is over 1000 h. p. It is to be used to drive the compressors and hoists at the mines. The total weight of the motor, boxed, ready for shipment, was 105,000 pounds, or 52½ tons. The weight complete of the motor with its accessories was over 120,000 pounds, or 60 tons, requiring two full cars to transport it.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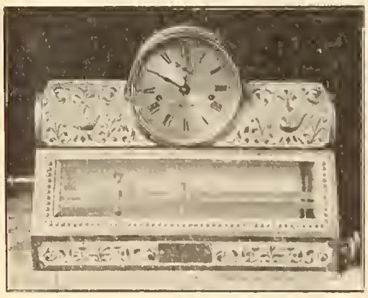

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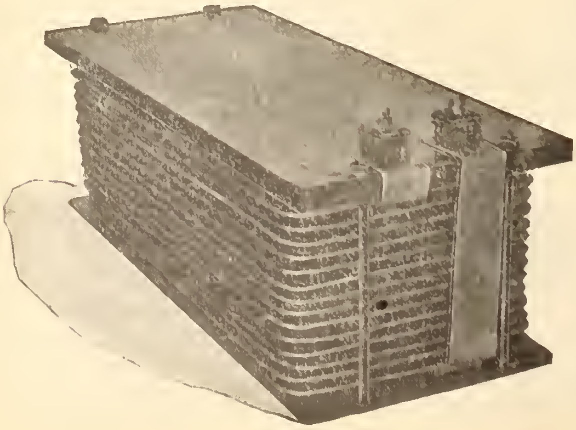

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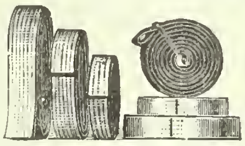

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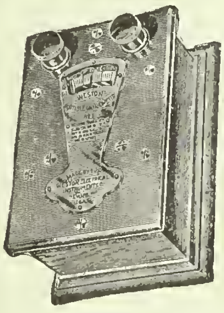
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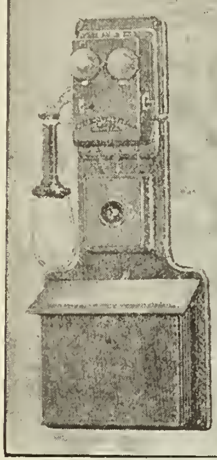

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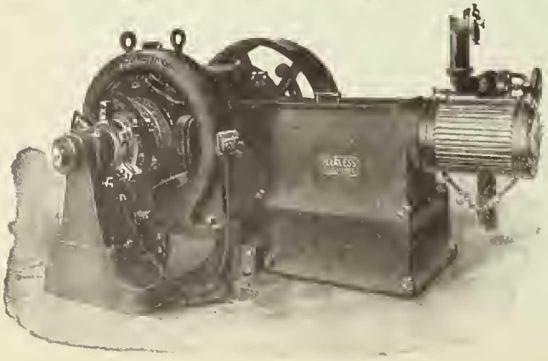

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